

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information

of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

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FRIDAY, JANUARY 18, 1907.

A decision was not long ago announced by the Attorney-General of Ohio to the effect that the collection of excess fares from passengers who, having failed to buy transportation at the ticket office, pay their fares in money on the train, is illegal; and this whether or not a refund check is given in return for the extra amount collected. We confess that this does not seem to us a wise ruling even if it can be justified under existing laws; yet while the practice of charging an extra amount in such cases without giving a refund causes irritation far out of proportion to the extra earnings from this source, the endeavor to make it inconvenient for the passenger who fails to buy his ticket before getting on the train to travel as cheaply as he would if he had bought his passage at the ticket window, seems in no way an arbitrary exercise of corporate power. The importance to railroad companies of having the money equivalent for transportation turned in at the ticket office rather than to the conductor is not small. It not only simplifies the work of the accounting department but takes away most of the opportunity for stealing by conductors. When a receipt which is of no value is given to a passenger he frequently pays no attention to it, where in case it were redeemable for even five cents he expects to receive it in return for his higher cash fare, thus forming a more complete check on the conductor's honesty than the valueless receipt. This consideration, however, is from the standpoint of the railroads, and would probably not appeal to the Attorney-General. On the other side, and directly affecting the comfort of travelers, is the possibility that as a result of such a decision, railroad companies may put in force the obnoxious system of requiring examination of tickets by a doorman at all stations. This system always causes a great deal of irritation to the traveling public, particularly in the case which so often happens where friends are not allowed to accompany passengers to the train. It is worth noticing that at all stations along the line on the road with the largest proportionate passenger receipts in the country, station platforms are open to everyone, the whole responsibility for the collection of tickets being thrown on the train conductor, where it finally belongs in any case. In short, at all except the largest terminal stations, freedom of access to station platforms seems clearly the better system. The other probably prevents some unauthorized persons from getting on trains and some heedless or inexperienced travelers from taking wrong trains as they otherwise would do, but these small advantages are by no means compensated for by

the annoyances caused to travelers under the locked door policy. Like so many other details of the dealings between the railroads and the public it may be hard to reckon in dollars and cents the advantages to be gained by the open-handed method, to set off against the possibilities of loss through free rides and accidents to passengers on station platforms, but the experience of the New York, New Haven & Hartford, probably the most complete territorial monopoly in the country, would seem to show that it pays to take risks of loss which are really small in proportion to the advantage of gaining good will on the part of the public.

From time to time during the past two or three years we have had occasion to show how the railroads of the country were passing through a "bond period" reaching through several years—that is to say, a period when new issues of bonds were not only large absolutely, but greatly exceeded new issues of stock. This would have been true probably even though bonds convertible into stock had been subtracted. But the records of the present year when fully made up are likely to show a remarkable change, not only for its abruptness, but for the amount of the new stock issues. The 1906 authorizations of the New York Central, the St. Paul, the Great Northern, and the Northern Pacific alone, taken together, mount up to \$405,000,000, and stock or convertible bonds have been poured out by other railroad corporations in a flood. A bond period thus seems passing swiftly into a stock period. If analyzed fairly the change does not seem to be due to any particular change in the mental attitude of railroad financiers as to the fundamental merits of stocking as compared with bonding, and a contingent dividend charge as compared with a fixed and invariable interest charge. Views of railroad managers on that point have varied and a good deal has depended on the special railroad case. The change has rather been due (1) to prosperity and net earnings, which, in most cases, not only have justified "rights" as an indirect dividend for shareholders, but made the shareholders expect them, and (2) the low borrowing potentiality of the railroad bond, even of the first class, and the inability of an overloaded market to "digest" new bond issues which would force prices still lower. Moreover, the fiscal managers of a big dividend-paying railroad corporation know that new issues of a stock which has stood well above par will be taken up, while there are apt to be grave uncertainties as to under-

writing on actual sale of new bonds. The interesting question is how long this new "stock period" is to continue. Is it transitory and resting measurably upon the effects of a high money rate, or is it, for two or three years at least, to be normal? If it proves normal with a great increase of the total dividend charge of American railroads, then the far look ahead suggests yet another interesting period, and, perhaps, a long one, during which mutations of railroad prosperity make dividend rates variable and the financial pendulum swings back to bonds.

A TRAINING SCHOOL FOR RAILROAD OFFICERS.

Altoona has been called the railroad university of North America, and with large justice. Not only is it the largest distinctively railroad town on any railroad system in the world, but it is the center of a system of railroad education more advanced and more successful than any other. These facts are, of course, familiar to readers of the *Railroad Gazette*, but it is worth while again to call attention to them, because the system of training there in force is unique in its workings and is an example which should, before this, have been more closely followed by other important roads.

As one of its tremendous classrooms, this railroad university has the largest freight yard in the world, seven miles long and with 221 miles of track. The central receiving point for the thick network of coal mine branches and feeders of the Pennsylvania, Altoona receives an immense tonnage of coal which is there redistributed for eastern points. It is also the headquarters of the Pennsylvania Railroad grand division of the Pennsylvania Lines East and one of the vital operating points for through traffic from the West. An idea of the importance of Altoona as a divisional point can be gained from the fact that the average freight movement through the Altoona yards is about 6,000 cars a day and 2,000,000 cars a year. To handle this traffic requires a force of 25 yardmasters and assistant yardmasters. The yards are operated on the hump system, and the despatch with which trains are broken up and redistributed into other trains, is one of the most remarkable examples of successful American railroading. The greatest railroad shops in the world with a total floor area of 50 acres are another gigantic classroom, an example of the highest types of American railroad shop practice. In all departments, including offices, shops and yards, the Pennsylvania employs at Altoona 15,000 men, who, with their families, make up most of the population of the place.

In this great center of railroad activity, college graduates come to take a post graduate course in railroading as special apprentices. This covers four years work in the shops, during which time a man is given practical experience in all the different shops as well as in shop accounting, drafting and testing. At the end of four years the special apprentice becomes a motive power inspector and works up through the position of shop foreman or assistant master mechanic to the rank of master mechanic. The motive power department at Altoona, including all shops, is in charge of the general superintendent of the Pennsylvania Railroad grand division, who, in managing the shops and in direct charge, is assisted by one of the four superintendents of motive power on the Lines East, who has his headquarters at Altoona. The superintendent of motive power occupies on the staff of the general superintendent a corresponding position for the motive power department that the one of the four principal assistant engineers who has his headquarters at Altoona does for the maintenance of way department. Altoona is also the headquarters of the general superintendent of motive power of the Lines East who, however, is not directly in charge of the Altoona shops, but only in an advisory capacity.

Under the principal assistant engineer are gathered, from all parts of the lines, young civil engineers eligible for promotion to the position of assistant supervisor. These are men who have entered the service of the company either in the construction department or in the offices of the superintendents. As they show fitness for advancement they are sent to Altoona where they become acquainted with the general routine of maintenance of way work and with Pennsylvania methods of operation. From assistant supervisors they become supervisors, assistant engineers and superintendents. The results of the Altoona system of training are shown in the fact that most of the motive power and operating officers on the lines east of Pittsburgh received their training at Altoona.

There is one respect in which this system of training for railroad work put in force by the Pennsylvania is particularly worthy of imitation by other railroads. Most other roads which have experimented with this or similar systems have limited their efforts

to planning a course of work which will give the necessary experience in one department or another, leaving the young apprentice to shift for himself after working hours. The Pennsylvania has made a point of looking out for the play-time as well as the work-time of its young men in training in both the motive power and maintenance of way departments. Altoona at best is not a garden spot. In summer, particularly, it is hot and disagreeable. Therefore, with the same care that would be used in building a new round house or car shop, the railroad officers have looked after the lighter side of life. They took hold of the Altoona Cricket Club, which had been in existence for many years, and turned it into a club for the officers, the special apprentices, and the rodmen, transitmen and other employees of the maintenance of way department. Altoona itself is on the crest of the Alleghenies and the club is on a high hill that lies far above the valley where the railroad tracks are. Golf links, tennis courts and indoor games, all the appointments of a well regulated country club, are provided, and at a nominal fee. The club is managed and supported by the company and proves a highly profitable investment, not in cash dividends, but in the better ability of men during working hours. In particular by the younger men this feature of the life of Altoona is appreciated, for there is no time when conditions of work usually bear harder than in the first few years. This side of the life at Altoona is an added reason why the place can be compared to a university, for the principle of "all work and no play makes Jack a dull boy," is in both places applied, and at Altoona, surely, with notable success.

CAR SHORTAGE AND INDUSTRIAL TRACKS.

The letter of Mr. Russell Harding to the Interstate Commerce Commission, printed elsewhere, in which the writer states his belief as to the chief cause of the present car shortage and congestion of traffic, with a suggested method for determining the extent of this cause, coming as it does from so high an authority, merits most thoughtful consideration. Numbers of high railroad officers, in commenting on the conditions of the past year and the outlook for the coming year, have expressed themselves strongly regarding the relief that would be afforded to the railroads should shippers and consignees provide suitable and adequate facilities for forwarding, receiving and storing goods. President Harahan, of the Illinois Central, for example, pointed out that if such improvements were made as would reduce the time cars were so held only one hour a day on the average, it would mean for his road alone 62,000 hours more of car service each day. Applying this to all of the roads, and for a year's time, and the potential increase in equipment from this source alone—slight as it is in its elements—becomes enormous. Mr. Harding says that despite the tremendous increase in volume of business in the past eight years there has been practically no increase in industrial tracks—meaning, doubtless, no *relative* increase, for of course there has been actual increase, the number of industrial concerns being much greater; and for this reason, he says, fully 90 per cent. of all of the cars that are held in the yards of railroads in the large business centers are for these concerns it being impossible to make prompt delivery because of the lack of industrial and team-track room. The plan which he suggests for verifying the truth of his claims not only would depict actual conditions in the matter of holding tracks and yards of the railroads, and of industrial tracks not owned by the railroads, at the beginning and end of the period over which he makes comparison—1898 to 1906 inclusive—but would form a valuable record of a sort not heretofore existing, and on which action looking to a betterment of these conditions could be intelligently based.

The question raised in the last paragraph of the letter, as to which of the interests should rightly assume the burden of correcting the fault, is novel in the suggestion that it might not be an unfair claim that the railroads should supply the tracks if the industries furnish the rights of way. However this point might be decided, it certainly would be greatly to the interest of all parties concerned to co-operate on the most friendly and unselfish basis in order to secure the facilities so badly needed. Considering the seriousness of the situation, and since a general and permanent improvement of the conditions in question means such a vast potential increase in yard room and in equipment, and failure to better them means the further immediate expenditure of large sums for additional yards, tracks and equipment, would it not be a wise and most profitable procedure on the part of the railroads to inaugurate an active and systematic campaign to induce all industries and business houses on their lines which lack adequate receiving, storage

and despatching facilities, to provide same, the railroads to co-operate to whatever extent their best interests dictate? If generally successful, such a plan would certainly be the cheapest way out of present difficulties and would afford a degree of relief obtainable in no other way.

SIBERIAN RAILROAD TRAFFIC DURING THE WAR.

The Russian official journal has recently published statistics of the traffic of the Siberian Railroad during the Japanese war, concerning which nothing definite had been published heretofore. The railroad had been opened through to the Pacific at Dalny but a short time before the war broke out, and so was only beginning to have a through traffic, which, of course, was then entirely interrupted. It had had, however, an important immigration traffic, and on the western divisions a very considerable grain and dairy traffic.

The whole number of passengers in the three years ending with 1905 were:

	1903.	1904.	1905.
Passengers: First-class	7,000	5,900	5,300
Second-class	62,300	70,100	74,000
Third-class	409,400	448,400	471,500
Fourth-class	455,300	240,500	172,300
Immigrants	142,600	33,300	30,400
Stock attendants	2,300	2,200	1,800
Soldiers—1st, 2d and 3d class	101,700	939,100	1,077,900
Prisoners and their guards	100,100	18,200	13,100
Total	1,280,900	1,757,800	1,846,300

Thus the total number of passengers increased 37 per cent. from 1903 to 1904, and 5 per cent. from 1904 to 1905; but subtracting the military travel, the number of other passengers decreased from 1,180,800 in 1903 to 818,700 in 1904 (30 per cent.) and to 768,400 (7 per cent.) in 1905. The through travel, largely first-class, but always very small, came to an end with the war. Even in 1903 there had been only 19 first-class passengers per day on this line of 4,000 miles. The second and third-class passengers continued to increase, there being a movement of army attendants and surveyors largely exceeding what otherwise would have traveled west of Lake Baikal; but the fourth-class travel fell off 47 per cent. from 1903 to 1904 and 28 per cent. from 1904 to 1905. This travel is chiefly of laborers going from one place where work is to be had to another; in European Russia, chiefly men employed in harvesting, who move north as the crops ripen. Men of this class in Siberia, if able-bodied, belong almost wholly to the army reserves, and the Siberian army reserve was all mobilized during the war. The reduction in the movement of prisoners, which seems frightfully large in 1903, was due largely to the cessation of banishment to the island of Saghalien, opposite the mouth of the Amoor.

The movement of troops naturally is the great feature of this period. No less than 939,000 soldiers were carried in 1904, and 1,178,000 in 1905. It must not be supposed that so great a number of different persons were carried. Aside from transfers from one place to another in Siberia, there is always a large movement from any army back toward the home of the soldiers, and in 1905 the larger movement must have been in carrying the bulk of the army back from Manchuria to Russia, which was chiefly, but not wholly, effected in that year. The movement of freight in this period increased greatly in most of the items which are reported, but these do not enable us to distinguish between what we may call the normal freight of the country and that due to the war. Of that carried by freight trains, the quantities, in tons, average as follows:

	1903.	1904.	1905.
Military freight	4,982	406,179	583,470
Private freight	1,182,581	1,242,270	1,452,740
Service freight	1,751,808	1,938,280	2,393,143

It is probable that in the aggregate the whole of the increase in what is here called "private freight" was due to the shipments of stores to be sold to the army; but the most notable fact in the statement is that the "service freight"—the supplies carried for the use of the railroad itself—exceed in amount the military and paying civil freight put together. Coal alone must have formed a very large part of this service freight, but other very large portions were due to material used in constructions to increase the capacity of the railroad. When the war broke out the railroad through to the mountains around the south end of Lake Baikal was not nearly completed; stations east of the lake were something like 30 miles apart, and the maximum capacity of the line was the movement of 10 trains each way daily. The construction of sidings and passing tracks had progressed so far that, by the end of 1904, 16 trains could pass each way daily, and by November, 1905, 20 trains daily. The requirements of the army made it necessary to limit strictly all shipments of freight which did not conduce to its support. The

statistics given show an increase in grain and flour shipments of 22½ per cent. from 1903 to 1904, and a further increase of 3 per cent. the next year. Of course the movement of flour and forage eastward for the supply of the army must have been great. Coal shipments were more than twice as great in 1904 as in 1903, and there was a further increase (37 per cent.) in 1905, when, however, the total coal shipments were only 288,227 tons.

Eloquent testimony as to the interruption of the growth of Siberia is given by the reduction of immigrants' freight from 7,200 tons in 1903 to 212 tons in 1904 and 59 tons in 1905.

RESPONSIBILITY FOR TROLLEY INFLATION.

The public agitation which has sprung up in several states, notably New York, New Hampshire and Connecticut, over defects of the state railroad commissions, is commendable and cheering in itself. But the cynical guide must be pardoned when one reflects how long this reformatory energy has had to wait, how often warnings have been uttered and exposures made by the so-called "technical" writers but without effect on either the public or the newspapers, and how the sins of omission and commission have gone on until now not a few of them are too late to rectify. These reflections, in the nature of afterthoughts, apply peculiarly to the state of Connecticut where just now there is a sudden and volcanic outburst against stock watering of the street railways. The immediate text is the disclosure of the huge volume of water transmuted into dividend paying stock by the recent absorption of the Connecticut Railway & Lighting Company. The exposure is far from new. But it happens to be accented by a big deal carrying figures of sensational magnitude. Hence the spectacle of Connecticut newspapers which have been silent on the topic for 15 years, now denouncing trolley inflation and the state railroad commission which countenanced it, in scare headlines and double-leaded editorial type. This process of closing the doors after the escape of the animals has its elements of diversion; but, more seriously, it has some historical hints on trolley inflation in Connecticut which are not the less instructive because typical of other commonwealths.

The first trolley wave struck Connecticut in the year 1888, though as a mild surge; a dead-locked legislature two years later created a law-making *hiatus* of four years during which no statutory business of any kind was done. It blocked and in a sense dammed up trolley projects until 1892, when they burst on the legislature in a flood. The state was thus measurably the victim of somewhat exceptional conditions. The trolley craze grew to wild-fire. Cities and suburbs, farms and the backwoods hailed the new motive force as a mighty local and economic helper. The steam companies at first resisted electric parallels successfully, later in vain. Fiscal aspects and ratios of capitalization were ignored and the state railroad commission continued to be the voluntary cipher that it had been before. Outside capital quick to see the profits of course rushed in, constructing street railways by bonds—often marketed below par—and "bonusing" the stock. It was a veritable trolley saturnalia that lasted almost a decade, during which new charters—if not paralleling steam lines—could be had for the asking, and the first speculators in old horse railroad territory got rich quick.

Now too late has come the disillusion. The economic mill, even in so exceptional a thing as the rise of electric street railways, grinds slow but it grinds sure and fine. Connecticut has awakened to a solid economic condition as contrasted with rash and thoughtless enthusiasm. The situation has been forced further by the threatened development of long distance electric rivalry. This has compelled the steam interests to buy up the dropsical trolley systems one by one until they are now unified under one control, similar conditions existing in Rhode Island and lower Massachusetts. Water original, secondary and in some cases tertiary, is solidified into shares that carry their fixed charge on the purchaser, and, next, on the public. Honest capitalization that might in many cases have connoted a three cent fare has become diluted capital exacting a five cent fare. And who is to blame? Obviously the Connecticut citizen who blinded himself both to existing facts and to easy forecast; next a legislature equally negligent but in which the current of intelligence could hardly be expected to rise above its source; and last, and, on the whole worst, a railroad commission supple, languid and inefficient always, only just now more vividly exposed as such. In other words, all three of the civic elements charged with the prevention of a public evil were inert when they should have been active.

Where is the redress? Plainly nowhere as regards the past. Connecticut wakes up too late. She has forced her steam interests to self-protection, she has legalized under the signet of her own state officers securities bought by innocent investors, by trustees and savings banks, and she stands committed to a condition which she has herself created and for which she must endure the logical penalty. She has, however, one or two minor offsets. For example, she will gain some tens of thousands in dollars by taxation based on watered stocks enhanced in market value by the new merger, and she probably has a few operated trolley lines that would be non-existent had speculative street railway building been at lower terms. For the rest she must "take it out" of a railroad commission made up of two politicians and an antique engineer now in his eighth decade. In the attacks now centering on that body in the Connecticut press one can find retributive justice and a measurable promise of future betterment. As to the general lesson its teachings reach far beyond the bounds of a small New England state which is far from unique in its experience of initial error and belated repentance.

NEW PUBLICATIONS.

The Crisis at Panama. By Lindon W. Bates. New York: Lindon W. Bates. 8½ in. x 11¼ in.; 87 pages; five illustrations.

In this interesting pamphlet the author calls attention to the experience of the French at Panama as it applies to the present plans for the canal. He points out that so far the Americans have gone ahead, particularly in the matter of labor, through exactly the same phases as their predecessors. Mr. Bates criticizes the estimates made of the time necessary for the completion of the canal and of the work necessary for the various locks. His own plan is to build but two locks, raising the water level to such a height as to create artificial lakes in the present most unhealthy regions.

Proceedings of the Fourteenth Annual Convention of the National Railroad Blacksmiths' Association. Edited by A. L. Woodworth, Lima, Ohio. 6 in. x 9 in.; 203 pages; 9 illustrations. Cloth.

A number of the papers included in this volume of proceedings have already been published in abstract in the *Railroad Gazette*. The complete list of the subjects discussed is as follows: Frogs and Crossings; Formulae for Rings; Flue Welding; Classification of Work in Shop; Tools and Formers for Bulldozers; Discipline; Best Method of Annealing High-Speed Steel, Also of Tempering Same; Case Hardening; Best Coal for Use in Smith Shop and Kind of Fires Used; Piece Work; Making of Locomotive Frames; Thermite; Furnaces; Proper Material for and Best Methods of Making Side Rods, Crank Pins and Motion Work in General; Designs of Furnaces and Economy in Fuel; Flue Welding; The Foreman and His Shop; Springs; The Apprenticeship System and the Utilization of Scrap Material. These subjects are usually treated quite briefly and the discussion upon them is equally brief. It is a practical presentation of a topic that frequently contains new ideas worthy of consideration and imitation, but which sometimes, also, is merely a recapitulation of current and established practice without suggestions for a betterment. The papers, as a whole, are, however, marked by an intensely practical consideration of the subject in hand.

CONTRIBUTIONS

Causes of Accidents.

New York, Dec. 31, 1906.

TO THE EDITOR OF THE RAILROAD GAZETTE:

There has been a great deal said and written lately regarding accidents on railroads and very little publicity has been given to the real cause of these accidents. An analysis of the causes of wrecks on a certain portion of a certain railroad for a year showed that, out of an approximately one thousand accidents, involving the interruption of traffic, about 48 per cent. were due to defective operation, 36 per cent. to defective equipment, and the remaining 16 per cent. to defective track. The statement attached gives the details.

The remedy for the first is certainly more rigid discipline and larger expenditures for supervision. The remedy for the second is a more intelligent expenditure for repairs to running gear and draft gear. The quality of the inspection given to freight equipment as ordinarily witnessed is apparently very inferior, and it would seem that greater attention, with possibly greater expenditures, to the repairs of cars would result in fewer interruptions to traffic.

As to the safety of a car, the word of a \$45 car inspector, who landed from Poland three weeks ago, is often accepted in preference to the opinion of the conductor who has been in the service for many years. Hundreds of times, long, heavy freights have been

delayed and train service demoralized because of the draft timber pulling out, which might have been avoided by the application of 10 cents' worth of bolts and 7 cents' worth of labor. A stitch in time saves nine. The remedy for the defective track is more intelligent supervision and insistence upon improved conditions. The occasions of spread track were all on side tracks, seldom used, and most of the other derailments due to defective track were on side-tracks or yard tracks. I have no doubt that, if all accidents were analyzed in this way, in detail, it would give to the supervising officer most valuable information as to the lines on which to look for improvements in the service.

SUMMARY OF ANALYSIS OF WRECKS.

Defective Operation.		Application of brakes	
Collision	48	Something dragging	14
Sidewipe	48	Miscellaneous	110
Break in two	30		—344
Disregard signals	22	Defective Track.	
Disregard orders	0	Broken rail	19
No flag out	1	Spread track	17
Misplaced switch	68	Switch	14
Run through switch	125	Frog	2
Misplaced lading	9	Guard rail	1
Miscellaneous	110	Stub switch	7
	—461	Crossing plank	0
Defective Equipment.		Obstruction	44
Dragging brake-beams	38	Hand-car struck	6
Burst air hose	13	Bad flagging	0
Broken truck	76	Miscellaneous	13
" draft rigging	17		—123
" wheels	52	Unknown	41
" axles	14		
Burnt journals	5	Grand total	969

Steam Versus Electric Locomotives.

New York, Nov. 27, 1906.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Referring to the article by Mr. Joseph Mayer in your issue of November 16th it would appear that the author has based his calculations of the horse-power developed by the locomotive upon the resistance per ton upon the level, as he has made no allowance for grades which form the most important part of the train resistance. Allowance is not made either for fuel consumed during stops or for acceleration. As such important matters are neglected in so well-known a matter as the locomotive, what confidence can be placed in the balance of the article, which deals with less known matters and are consecutively based upon one assumption or another? Is it not preferable to depend upon statements derived from actual working, as given by Mr. J. A. F. Aspinall and quoted in your issue of October 12th, where he distinctly says: "The cost per ton-mile for coal, for instance, is greater?"

ROGER ATKINSON.

The Interstate Commerce Act as Amended.

BY FRANK HAIGH DIXON.*

The new law widens materially the scope of the Commission's authority, and includes agencies of transportation that have heretofore been free from governmental control. The term "common carrier," as used in the act, now includes express companies, sleeping-car companies, and persons or corporations engaged in the transportation by pipe-lines of oil or other commodity except water or gas. Express companies have long been held to be common carriers in law, but they have been exempt heretofore from any attempt at control. In the first year of its existence the Commission decided that the original Interstate Commerce law was not sufficiently clear to warrant it in taking jurisdiction of any such companies except those conducted by the railroads as a part of their business. Consequently, it declined to exercise any authority over express companies at all. As a result, express companies have published no rates or traffic statistics and no financial reports. So far has this policy of secrecy been carried that, in the case of one company, it has recently caused a revolt among minority stockholders.

The act extends the meaning of the word "railroad" to include switches, spurs, tracks and terminal facilities of every kind, and all freight depots, yards and grounds. "Transportation," which, in its indefinite form under the old law, included "all instrumentalities of shipment or carriage," now includes cars and all other vehicles, and all instrumentalities of shipment or carriage irrespective of ownership or contract, and all services in connection with the receipt, delivery, elevation, transfer, ventilation, refrigeration, storage and handling of property transported. Every carrier is obliged to provide such facilities upon reasonable request, and to establish reasonable rates applicable thereto.

Rebates and Discriminations.—The Elkins Act of 1903 has doubtless done away with many of the common forms of rebating. Yet the Commission in its last published report, that for 1905, finds itself compelled to admit that the giving of rebates has been resumed. New and elaborate devices have been employed on a large scale for the purpose of evading the statute. Among these the most important are the private car and the industrial railroad. The practical monopolization of refrigerator equipment by one corporation.

*Abstract of a paper in the *Quarterly Journal of Economics*.

and the identity of car-owner and shipper, are responsible for the evils, and the testimony given before the Senate Committee which held hearings in the spring of 1905 is filled with allegations of exorbitant rates for refrigeration, icing and special forms of packing, and with the difficulties that shippers encounter in the settlement of damage claims because of the divided responsibility of railroad and car-owner. The new law gives the Commission authority over all services performed by private-car lines, and expressly requires the publication separately of all terminal, storage and icing charges, or those for any other facilities or privileges granted. The complaint of divided responsibility between railroad and car-owner has been met by holding the railroad responsible for the provision of such special equipment upon reasonable request.

The terminal railroad, variously known as the "tap-line," or industrial railroad, has been, in the judgment of the Commission, one of the most dangerous and effective means of evading the law. Such a road built by an industry to connect with a main line, instead of securing from the road to which it delivers its freight merely a reasonable switching charge, obtains an undue proportion of a through rate which amounts to a rebate. The new law extends the jurisdiction of the Commission over such connecting lines, and gives it power to determine a proper switching charge or a proper proportion of a through rate. At the same time a railroad is required, on application of a branch line or shipper, to build and operate on reasonable terms a switch connection, where such connection is reasonably practicable and where business warrants it, and to furnish without discrimination cars for the movement of traffic.

Another serious and elusive form of discrimination has been practised with special success by the coal roads. By virtue of being owners of coal mines and transporters of their own product, as well as that of independent operators, they have been enabled so to manipulate their books that it has been impossible for either the Commission or the courts to decide whether the advantage which they enjoyed over independent shippers should be regarded as a discrimination granted to themselves as carriers or a loss suffered by them as producers. The extraordinary situation revealed in the affairs of the Pennsylvania Railroad by the investigation of the Interstate Commerce Commission while the rate bill was under discussion in the Senate, combined with the sentiment fostered by long-continued troubles in the coal fields, resulted in the incorporation of a radical clause, which provides that after May 1, 1908, no railroad will be allowed to transport in interstate commerce any commodity, other than timber or its manufactured products, produced by it or under its authority, or which it may own in whole or in part, or in which it may have any interest direct or indirect, except such as may be necessary and is intended for its use as a common carrier.* Inasmuch as the term "railroad" includes switches, spurs, terminal facilities and yards, it will compel all owners of terminal elevators and of businesses connected by tap-lines to give up one business or the other. A railroad can now be engaged in no other business than that of transportation. Of course, most of the terminal facilities are intrastate in their ownership, but the jurisdiction of the Commission will extend to all their interstate shipments. That the financial problem involved in this clause was appreciated is shown by the fact that nearly two years are to elapse before it becomes effective.

The Act of 1887 contained no express prohibition of the granting of passes. The new law leaves no doubt as to its intention in this matter. Common carriers are forbidden to give directly or indirectly, and persons are forbidden to use, any interstate free ticket or pass. Two general classes of exceptions are made. The first includes railroad employees and their families, officials, railroad surgeons and attorneys, and employees of agencies associated with the railroad business, such as those of the sleeping-car, express, telegraph, postoffice, customs and immigration service, caretakers of live stock, and newsboys and baggagemen on trains. The second class comprises the poor and unfortunate classes and those engaged in religious and charitable work.

The Elkins Act of 1903 has been strengthened by making both giver and receiver of a rebate liable to imprisonment as well as fine, and by compelling the recipient of the favor, in addition to these penalties, to forfeit three times the value of the consideration received. It is perfectly obvious that a vigorous enforcement of the imprisonment penalty would dispose of the rebate question once for all. Whether we have reached the point in our criminal procedure when we have the courage to put our financiers and our railroad presidents behind the bars for an offence of this character is another question.

Rates.—The question of conferring specifically upon the Commission the rate-making power has been the topic about which all discussion concerning the amendment of the Interstate Commerce law has centered. It was the main suggestion of President Roosevelt in his presentation of the subject in the messages of 1904 and

1905. It was the topic of greatest interest and most general discussion in the hearings before the Senate Committee. It formed the main theme of the speeches in both Houses of Congress. Such a power is designed to reach the published rates, not secret rates, which are covered by the sections forbidding rebates and discriminations. Excessive rates, those unreasonable in and of themselves, if they exist at all, are of comparatively small importance, but relatively unreasonable rates have been the subject of long-continued and bitter complaint. A shipper is not so much interested in the rate he pays as he is in seeing to it that his competitor pays the same rate. The Supreme Court's decision that the Commission could not prescribe a rate for the future left to the shipper merely the privilege of suing for excessive charges when a rate had been held by the Commission to be unreasonable. This the individual shipper usually failed to do, the amount in controversy in any individual case being usually too small to warrant it. Moreover, the one who paid the freight rate was frequently a middleman, and the individual who actually suffered from the excessive rate, the consumer or the producer, had no standing in court and could not recover. The only adequate relief from such a situation was to clothe the Commission with power to prevent such occurrences in the future. The rate section of the amended act provides that the Commission shall have power, on complaint, whenever the rates or charges or any regulations or practices are unjust or unreasonable, to prescribe, after full hearing, the reasonable regulation or the maximum rate, and to make an order that the carrier shall cease from violation of the statute. All orders except those for the payment of money are to go into effect in not less than 30 days, and to remain in effect for not more than two years, unless suspended, modified or set aside by the Commission or suspended or set aside by a court of competent jurisdiction. Express jurisdiction is conferred on the Circuit Courts in suits to enjoin, set aside or suspend orders of the Commission. It required, however, that no injunction or interlocutory degree, suspending the order of the Commission, should be granted except after not less than five days' notice to the Commission.

Under the old law the Commission had no power to compel the making of a joint rate, and the railroads could nullify any order of the Commission which declared any such rate unreasonable by refusing to agree upon divisions of the through rate. The Commission is now given power, after hearing, to establish maximum joint rates, to prescribe their division among the carriers concerned, and to establish through routes and the terms and conditions under which they shall be operated whenever the carriers have refused or neglected to do so voluntarily. This provision also applies when one of the connecting carriers is a water line. The old law, in the case of both local and joint rates, required a 10 days' notice of any advance and a three days' notice of any reduction. By various devices, the most objectionable of which was the so-called "midnight tariff," which gave favored shippers advance information of a contemplated reduction of rate, and immediately restored the old rate when these shippers had profited by it, the provisions of the section were rendered of little value to the public. Under the new law, schedules of both local and joint rates must be filed with the Commission and publicly posted, and, where no joint rates have been established, each carrier must file the rates applied to through transportation. The schedules must also state separately all terminal, storage and icing charges, and all privileges and regulations which in any way affect the service rendered. Thirty days' notice is required of any change in these rates unless the Commission for good cause modifies the requirement.

Accounting.—The importance of the section of the act relating to annual reports has been little appreciated. The new section grants to the Commission all that the most ardent advocate of publicity of accounting could desire. It requires that annual reports shall be made out under oath, and imposes penalties for failure to file them with the Commission within the prescribed time. It empowers the Commission to call for monthly or special reports. It gives the Commission authority, in its discretion, to prescribe the bookkeeping methods of the carriers, gives it access at all times to the books of the railroads, and authorizes it to employ special examiners for the purpose. Fine or imprisonment, or both, are imposed upon persons who wilfully falsify or mutilate records or neglect to make the proper entries, and jurisdiction is given to the United States courts to issue writs of mandamus in the enforcement of the provisions of the section.

Among the minor changes may be noticed the so-called Carmack amendment, which provides that carriers receiving interstate shipments must issue a through receipt of bill of lading therefor, and become liable for the shipment, no matter on what road the loss or damage occurs; but the initial carrier is entitled to recover from the carrier on whose line the loss takes place. The Commission is enlarged from five to seven members, only four of whom shall be of the same political party. Their term of office is extended from six to seven years, and their salary is increased from \$7,500 to \$10,000 per year. These changes mean an increase in the dignity and influence of the Commission.

*The decision of the Supreme Court on Feb. 19, 1906, in the case of the Chesapeake & Ohio Railway (*Railroad Gazette*, Feb. 23 and March 2, 1906), probably had much influence in the enactment of this clause.

The omission which will be most keenly felt in the enforcement of the new statute concerns the relation of long and short haul rates. Section 4 of the old act, which made it unlawful for a carrier to charge any greater compensation in the aggregate for transportation under substantially similar circumstances and conditions for a shorter than for a longer distance over the same line in the same direction, the shorter being included in the longer distance, robbed of all its vitality by Supreme Court decision,¹ stands unamended. It is evident that a large breeding place of discrimination and undue preference has been left undisturbed, and that the arbitrary basing point system of the southern roads may continue its existence unmolested.

There are two other regrettable omissions in the statute. The one is the failure to bring under the jurisdiction of the Commission carriers engaged in inland transportation by water.² Of more importance is the failure to repeal Section 5 of the old law which prohibits pooling. Such a result was hardly to be hoped for in the present temper of public opinion, and in view of the fact that rates have been advanced since the era of railroad consolidation. But it is the widespread conviction of students of the problem that the pooling of traffic by competitive lines, under close supervision of the Commission, would materially improve the railroad situation by securing uniform and stable rates, and by eliminating a great part of the place discriminations. The theory clung to so tenaciously by the people at large, and given weighty sanction by the decisions of our highest court, that competition can be relied upon to give shippers reasonable rates, is utterly impracticable when applied to the railroad industry. The conversion of the informal and secret agreements between carriers which now prevail, and which in the nature of things must prevail, into open legal contracts sanctioned and regulated by the Commission, must be effected sooner or later if this railroad problem is to be solved by other means than by government ownership.

Engine Failures and Their Report.*

Failures of engines in service interest so many departments of a railroad directly or indirectly, as well as the traveling or shipping public, that every energy is bent toward avoiding them. Shortage of power at times may compel the use of engines on the road which, under ordinary circumstances, would be held for back-shop repairs. These engines, then, should not be expected to handle full tonnage, but should be favored to a degree decided upon by the master mechanic in charge. But, on the other hand, no engine should be permitted to start on a trip unless the roundhouse foreman is sure, to the best of his knowledge, that the engine will make the trip successfully if it is handled properly and is not delayed unreasonably. Particularly is this latter condition true in what are known as bad water districts, as has been definitely demonstrated. And, too, an engine crew should be given as much consideration as the engines. They cannot work perpetually on short hours of rest unless their working hours are made short.

It is naturally during a rush period, whether of short or long duration, that engine failures increase in number and often also in proportion to the total miles run in a given period of time. However, there is a practice which, if once tried under such conditions, is usually adopted—i. e., reduced tonnage. There is the consequent increased speed over the road, more frequent attention to engines in roundhouse, shorter rest hours required by engine crews, and more cars handled in the same time. This is very pronounced on single track roads where a great deal of time is consumed in waiting at meeting points. The train despatcher can make better meeting points and the petty annoyances on the engine which make trouble and delays on tonnage trains have no effect. It may be that the cost per ton mile of freight per train is slightly increased, but the cost per ton mile of freight handled in the given period of time is not, for one or two engine failures will quickly wipe out the figured profits of full tonnage trains.

An engine failure, when charged, should be fair and just. The plain fact that an engine has died on the main line, or has given up its entire train and has come to the terminal caboose "bounce," is not in itself a cause for the recording of an engine failure. Very often the circumstances are such that a credit mark should be given instead of a demerit. Many of us know of instances on outlying divisions, where up-to-date roundhouse equipment is not very extensive and roundhouses themselves are not elaborate or frequent, when an engine has been worked back and forth between outlying points and the despatcher wants to make one more trip before sending it in as requested. In an endeavor to help the despatcher, the engine crew will attempt to do what is asked of them. The consequence is that a train is left on the main line, or some important movement is delayed. Is that properly an engine failure, or is it

a man failure? Such a case surely is one for investigation first before reporting.

The failure report should be accurate as to facts. These reports originate usually in the train despatcher's office. Too often the compilation is left until the last moment when every one is in a rush and when the easiest way is to take the notes from the train sheets. As a consequence, any occurrence which has annoyed the despatcher during his trick is charged as an engine failure if there is half a chance. The result is that the division superintendent and the master mechanic, as well as other division officers, are bothered with useless letters and memoranda sustaining charges and making explanations of a petty incident that should have been thoroughly sifted on the spot. This not only wastes valuable time of responsible men, but creates an undercurrent of feeling that often in the end causes bitter enmity. On the other hand, imagine what would have been the result if the despatcher had stopped for a moment before making the record, had obtained all the required information and had considered as to whether the service had been delayed or not, forgetting his own personal annoyance. Every one would have been happy, all had smiling faces and been ready for a dig into the work of the division instead of a dig into the other fellow.

The failure report should be definite as to details; that is, it should not say "leaking" when there are no flues that can leak, stay-bolts that can leak, mud ring that can leak, etc. It should not say "not steaming" when flues stopped up, honey-combed flue-sheet, poor coal, green firemen, leaky steam pipes, etc., can be selected as the definite cause.

And finally the record should stay when once made. If the proper care, as roughly outlined above, is taken, there will be no such thing as having "failures" canceled.

But what constitutes an engine failure? Is it not a train failure or delay for which the engine or its crew are alone responsible? With this thought in view, the Chicago & North-Western has adopted the following rules for guidance in making engine failure records.

DEFINITION OF WHAT CONSTITUTES AN ENGINE FAILURE.

1. All delays waiting for an engine at an initial terminal, except in cases where an engine must be turned and does not arrive in time to be despatched and cared for before leaving time.
2. All delays on account of engines breaking down, running hot, not steaming well, or having to reduce tonnage on account of defective engine making a delay at a terminal, a meeting point, a junction connection or delaying other traffic.

DELAYS THAT SHOULD NOT BE CONSIDERED AN ENGINE FAILURE.

1. Do not report cases where engines lose time and afterward regain it without delay to connections or other traffic.
2. Cases where a passenger or scheduled freight train is delayed from other causes and an engine (having a defect) makes up more time than she loses on her own account, should not be called an engine failure.
3. Do not report delays to passenger trains when they are less than five minutes late at terminals or junction points.
4. Do not report delays to scheduled freight trains when they are less than twenty minutes late at terminals or junction points.
5. Do not report delays when an engine is given excess of tonnage and stalls on a hill, providing the engine is working and steaming well.
6. Do not report delays on extra dead freight trains if the run is made in less hours than the miles divided by ten.
7. Do not report engine failures on account of engines steaming poorly, or flues leaking, on any run where the engine has been delayed on side tracks other than by defects of engine, or on the road an unreasonable length of time—say fifteen hours or more per 100 miles.
8. Do not report an engine failure for reasonable delays in cleaning fires and ash-pans on the road.
9. Do not report failures against engines that are coming from outside points to the shops for repairs.
10. Do not report cases where an engine is held in the roundhouse for needed repairs, and called for by the operating department, they being informed that the engine will not be ready until a stated time. Failure to provide that engine before that stated time should not be called an engine failure.
11. Do not report broken draft rigging on engines and tenders caused by air being set on train, account of bursted hose or breaking in two.
12. Do not report delays to fast schedule train when the weather conditions are such that it is impossible to make the time, providing the engine is working and steaming well.
13. Do not report delays when an engine gets out of coal and water, caused by being held between coal and water stations an unreasonable length of time.

In collecting the information for the failure the engineman and the despatcher are the first ones concerned. The engineman advises the despatcher just what is the trouble with the engine and says what must be done to get the engine to the terminal or place of tie-up. His statement shows whether the boiler, the machinery, or

¹ Alabama Midland Case, 168 U. S. 144, 173.

² This refers only to all-water lines, water carriage that forms with rail transportation a through route, being now under the jurisdiction of the Commission.

*A paper presented at the January meeting of the Western Railway Club by W. E. Dunham, Master Mechanic, Chicago & North-Western Ry.

special attachment are troubling, and gives a brief detail of what is wrong. The despatcher then advises the master mechanic or the division foreman and also the local foreman of the terminal to which the engine is going. As soon as the engine arrives the roundhouse foreman makes a close examination and prepares a statement which he sends to the master mechanic along with the engineman's written explanation. These various statements give the master mechanic full knowledge of the case, and he should have these papers within twenty-four hours after the failure occurred. In this prompt action rests a large part of the value of an engine failure report for the division officers. It convinces everybody concerned that things are being watched, and that indifference to the service will be treated accordingly.

The final ten-day or monthly statement of failures for the division is of value to both the operating and the mechanical departments. To the former it should show the result of long hours on the road on both engine and engine crew as well as train crew, the result of inferior coal, poorly designed and operated coal stations, scanty and bad water supply, overloading of engines, indifferent train despatching, lack of harmony in action on the part of the men in charge of a train. To the mechanical department the report gives not only all this same information, but it also shows up poor design, weak parts, inferior material, bad shop practices, careless handling, indifferent inspection and poor workmanship. In order to fully indicate these defects the roundhouse foreman sends in with his personal examination report a marked sketch of the defective part.

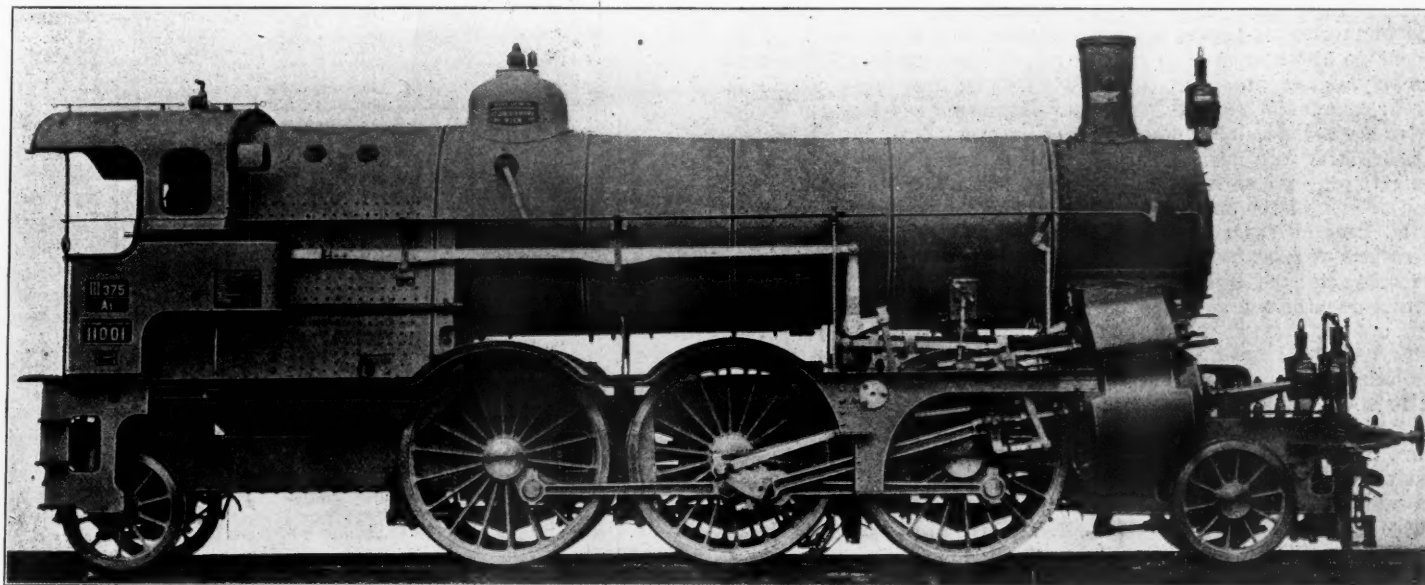
With a view to having uniformity in these reports and save time, blank breakage report forms, printed in copying ink, are

Four Cylinder Compound Locomotive; Austrian State Railways.

BY REGINALD GORDON.

London *Engineering* of November 16th last published a description of a 2-6-2 four-cylinder balanced compound locomotive, one of a number now building at the Florisdorf Works, Vienna, for the State Railways of Austria. An examination of the illustration of this locomotive, reproduced from *Engineering*, shows what has been growing more and more noticeable during the last five or six years, the closeness with which American and European locomotive practice approach each other. Naturally the kind of service and the requirements of traffic modify the designs in each country, but the development of certain definite types and the incorporation in the design of certain features is so plain to anyone who carefully observes locomotive practice on both sides of the ocean, that the distinction between this country and Europe in this respect is no longer so marked as it used to be. For instance, by way of comparison, note the adoption of the 4-4-2 type of locomotive in Great Britain and Europe, and the increasing use of the Walschaerts valve gear in the United States; the increasing size and power of British and European locomotives, and the use of outside connected cylinders thereon, while we in this country are developing the four-cylinder compound along European lines, and beginning to use superheaters. In short, each country has to a certain extent been making use of ideas developed in the other, so that the locomotives of either one resemble those of the other closely.

These remarks are suggested by the subject of this sketch, a four-cylinder compound 2-6-2 engine, with extended wagon top boiler



Four-Cylinder Compound Six-Coupled Locomotive for the Austrian State Railways.

used. The local master mechanic and shop foreman first make use of these reports by inspecting the broken part, if necessary, investigating the matter of its preparation and application. They are then forwarded to the assistant superintendent of motive power and machinery, where they are again checked up and where, by the frequency of similar reports, attention is drawn to some particular defect. It may be some one design of cylinder head, rod strap, eccentric or strap, or any such part of the machinery of a certain class of engine is regularly giving trouble. These reports quickly show it up to those who have such matter in charge, and the detail is quietly and efficiently remedied without the necessity of any further investigation. Such would be the case if the shops are at all careless in preparing the detail and are passing as good enough parts that are not true as to dimensions, etc.

After the assistant superintendent of motive power and machinery is through with the reports they are sent to the mechanical engineer, who checks the dimensions of the broken pieces and makes use of the data obtained in designing new parts for old engines or preparing plans for new ones. If he finds that some old style of detail designed several years ago is not holding up under the present-day methods of operation, he takes steps to have it discarded as fast as possible and substitutes a modern design. He also strengthens a pattern here and rearranges the metal there with a view to overcome external and internal defects that have been brought out by these reports.

As a further record and for the purpose of comparison, a monthly statement is prepared in the office of the superintendent of motive power and machinery, which classifies and details the failures and also shows totals for each division of the railroad.

and wide firebox. The cylinders are all four on the same transverse line under the smokebox, but set at an inclination to the horizontal. The low-pressure cylinders are outside and the high-pressure inside, and all four drive the second axle, an arrangement rendered possible by the height and inclination of the cylinders, the high-pressure guides being above the forward driving axle far enough to allow the high-pressure main rods to clear it. All four cylinders have slide valves, operated by Walschaerts gear, and the high-pressure valves are driven by a connection at the back end of the low-pressure valve stems through a rocker attached to each. The boiler is of the extended wagon top radial stayed type, with its center 9 ft. 5 in. above the rails. It is 61 in. inside diameter and has a wide firebox with 43 sq. ft. of grate area. The trailing truck has inside bearings. Altogether, the locomotive has a decidedly American look and is worthy of notice by engineers both here and abroad.

The weights and principal dimensions follow:

Boiler pressure, per sq. in.	220 lbs.
Cylinders, diameter high-pressure	14 7/16 in.
Cylinders, diameter low-pressure	24 1/16 in.
Stroke of cylinders	28 3/4 in.
Diameter of driving wheels	5 ft. 11 1/2 in.
Diameter of leading and trailing wheels	3 ft. 4 1/2 in.
Rigid wheel base	12 ft. 10 in.
Total wheel base	31 ft. 2 in.
Boiler, inside diameter	61 in.
" tubes	282
" diameter, 2 in.; length	17 ft. 1 in.
Grate area	43 sq. ft.
Total heating surface	2,775.3
Weight on driving wheels	96,100 lbs.
Total weight in working order	154,340
Tender capacity, water	3,720 gals.
Tender capacity, coal	7 1/4 tons.

Tests of Bond Between Concrete and Steel.*

The results of tests that have been reported on the strength of bond or adhesion between concrete and steel for plain, round and square bars are remarkable because of the lack of uniformity and wide variation, and indicate that there are so many conditions effecting this value even in laboratory experiments that engineers may well question if any dependence at all can be placed upon the adhesion of plain bars to concrete. The writer has studied all the results of bond or adhesion tests that have come to his attention. He finds from these reports that the strength of bond or adhesion obtained for plain bars embedded in Portland cement mortar and Portland cement concrete ranges from less than 100 lbs. to over 800 lbs. per square inch of embedded surface of plain bars.

The reports studied by the writer include the following, the figures accompanying the names indicating the minimum and maximum results reported in each case in pounds per square inch of embedded surface of plain round and square bars.

Zeitschrift des Vereins Deutscher Ingenieure (Vol. 49, '05) Cement	
Age, October, 1905.....	83 to 592
E. Morsh (from <i>Beton und Eisen</i> , 1903).....	100 " 696
E. S. Wheeler, U. S. Assistant Engineer.....	111 " 556
Prof. A. N. Talbot, University of Illinois.....	174 " 386
Prof. C. E. DePuy, Lewis Institute.....	188 " 341
Prof. C. W. Spofford, Massachusetts Institute of Technology.....	219 " 374
S. W. Emerson, Case School of Applied Science.....	278 " 587
Prof. F. H. Constant, University of Minnesota.....	316 " 854
Prof. W. K. Hatt, Purdue University.....	470 " 756
Professor Bauschinger (from Buel & Hill).....	570 " 640

This strength of bond or adhesion depends upon the following factors, any or all of which may vary: Quality of cement; character of sand or stone rust used in the mortar; ratio of cement to sand or stone dust; sizes of gravel or broken stone used in concrete; ratio of mortar to gravel or broken stone; degree of plasticity or percentage of water used in mixing mortar and concrete; thoroughness of mixing process; car with which mortar or concrete is placed; amount of leakage of mortar from concrete because of defective forms; possible disturbance of concrete during time of setting, breaking the initial adhesion to bars (this may easily result from tamping on or near concrete that has taken its initial set); the condition of the surface of the bars, and the age of the concrete.

M. Breuille reports in the *Annals des Ponts et Chassees*, 1902, the results of tests made to ascertain the action of water and moisture on reinforced concrete. He reports that by soaking in water for nine months the adhesion between iron and concrete is reduced from one-half to two-thirds, and in time the adhesion is entirely destroyed. This is of vast importance in connection with tunnel, foundation and bridge or culvert work.

It is evident that some positive mechanical bond between steel bars and concrete must be used in reinforced concrete structures to insure their permanence and reliability. In order to investigate the relative strength of bond developed by different forms of bars in the same kind of concrete and under otherwise identical conditions, the writer arranged with C. E. DuPuy, Professor of Mechanical Engineering in Lewis Institute, Chicago, to make a series of bond tests, in which not only the stresses necessary to pull out the bars would be recorded, but also the amount the bars moved or slipped under increments of stress would be recorded. He submits herewith Prof. DePuy's report of these tests. In doing so, the writer desires to call attention to the fact that so far as he is aware these are the first tests, the results of which have been published, in which any record of the amount of the slip of the bars as well as the stresses on the bars have been recorded.

A series of tests were made at the U. S. Testing Laboratory at the Watertown Arsenal recently to determine the "adhesion resistance of steel bars in cement and mortar prisms." In these tests both twisted and corrugated bars were tested. In the report it is stated, that the "concrete prisms were secured in the jaws of the testing machine between V-shaped wooden cushions, against which a sufficient compressive force was applied to hold the specimens in place against the tensile pull on the bars." The report goes on to say, "this lateral pressure in the sides of the prisms prevented their splitting lengthwise during the tests and in some degree probably resulted in applying pressure against the sides of the embedded bars." In the writer's opinion this was an unscientific way in which to make such tests, as the lateral pressure of the jaws enormously increased the friction bond between the bars and the concrete and vitiated the results as a consequence. The effect would be most marked upon the adhesion or bond of the twisted bars as they depend for bond entirely upon the wedging action of the inclined planes which the sides form because of the twisting. As a consequence, these results are entirely at variance with the results obtained by Prof. Spofford at the Massachusetts Institute of Technology, Prof. Constant at the University of Minnesota, and Prof. C. E. DePuy at Lewis Institute. Moreover, none of these reports except Prof. DePuy's brings out the fact of how much the bars slip before the maximum load is reached, and this is a most important feature to consider in bond tests. In Prof. DePuy's report, Table IV shows the relative strengths and efficiencies of bond of the different bars

tested by him at the point where the slip did not exceed $\frac{1}{100}$ in. The writer desires to express his appreciation of the very careful and scientific manner in which Prof. DePuy conducted this series of tests.

REPORT OF TESTS.

Object.—The object in making these tests was to determine the relative strength of bond between concrete and steel for different shaped bars, when the quality of concrete was uniform and the lengths of embedment the same for each of the several different kinds of bars. Also to measure the amount of slip, as well as the loads of stresses causing the slips.

Scope.—In order to make the results comparable, bars were secured for the tests having as nearly as possible the same average area of cross section and weight per foot as shown in Table I.

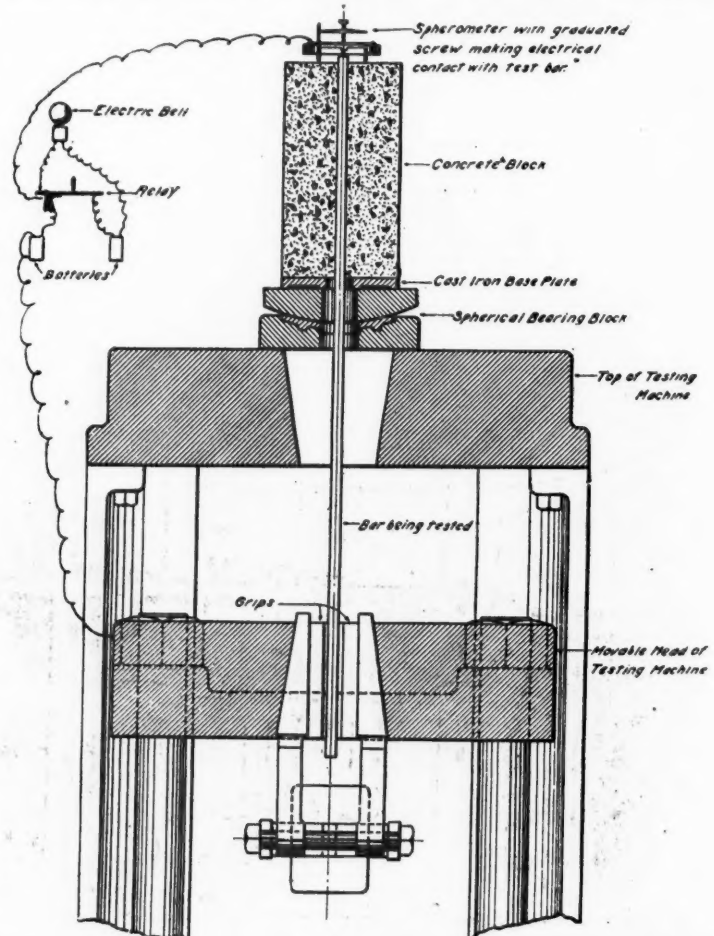


Fig. 1—Apparatus for Testing Bond Between Concrete and Steel.

There were seven kinds of bars tested and five lengths of embedment of each kind. The lengths of embedment were 8, 12, 16, 20 and 24 in. for each kind of bar.

TABLE I.
Description of Bars Used in Tests.

Bars.	Size.	Weight, per ft., lbs.	Average	
			Area, sq. in.	Perimeter, ins.
Round.....	$\frac{11}{16}$ -in.	1.284	0.378	2.17
Square.....	$\frac{5}{8}$ -in.	1.322	.390	2.50
Twisted (B)*.....	$\frac{5}{8}$ -in.	1.343	.395	2.51
Twisted (R)†.....	$\frac{5}{8}$ -in.	1.345	.395	2.51
Thacher.....	$\frac{3}{4}$ -in.	1.310	.385	...
Corrugated (N)‡.....	$\frac{5}{8}$ -in.	1.250	.368	2.43
Corrugated (O)§.....	$\frac{3}{4}$ -in.	1.443	.424	2.60

*Buffalo Steel Company, 2.3 twists per foot.

†Ransome, 2.8 twists per foot.

‡New style.

§Old style.

Apparatus.—The apparatus used is clearly indicated in Fig. 1. The concrete blocks were cylindrical, 6 in. in diameter, and 8, 12, 16, 20 and 24 in. long respectively. Each concrete block had a cast iron base plate, turned to a true face. These blocks were supported upon a spherical bearing block on the top of an Olsen testing machine, so that the specimen could be properly adjusted for a direct pull on the bars. The lower projecting end of the bar was gripped into the movable head of the testing machine. The upper end of the bar projected $\frac{3}{4}$ in. above the top of the block, while upon the concrete block rested a spherometer with the graduated screw brought into contact with the upper end of the bar being tested, thus closing an electric circuit. As the load came on, the slightest slipping of the bar in the concrete would break the electric circuit, causing a bell to ring until the graduated screw was turned down and the circuit closed. By this means it was possible to measure very accurately the movement of the bars and the load causing the same.

Materials.—Table I gives the general description of the bars

*A paper presented to the Western Society of Engineers, Dec. 5, 1906.

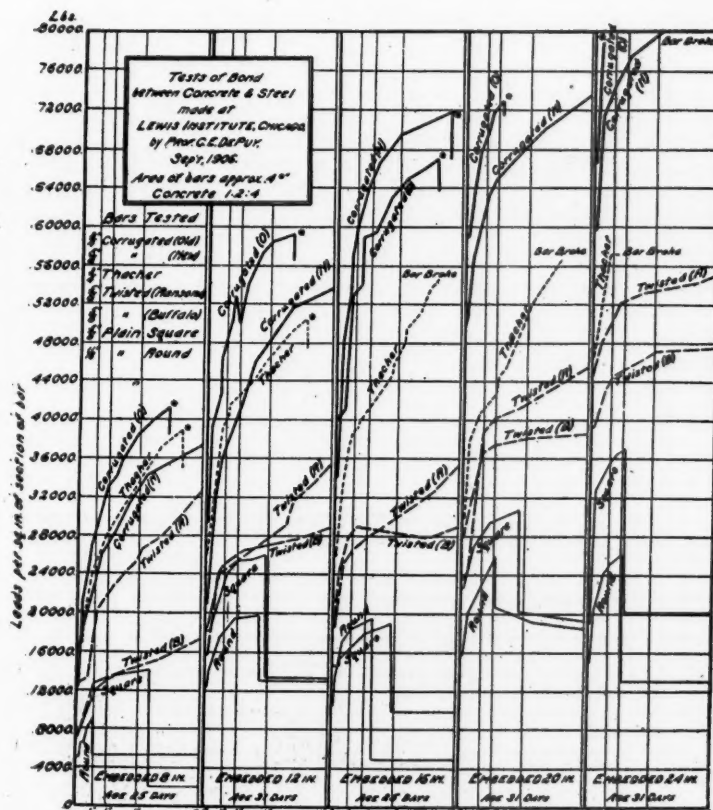


Fig. 2.

used. The round and square bars were of steel furnished by Jos. T. Ryerson & Sons, Chicago, and taken from their regular stock of structural steel bars. The twisted bars (B) were furnished by the Buffalo Steel Company. The twisted bars (R) were furnished by Messrs. Hough & Company, Chicago, representatives of the Ransome Concrete Machinery Company. The Thacher bars were furnished by The Schofield Company, Philadelphia, and the Johnson corrugated bars were furnished by Condron & Sinks Company, Chicago, representatives of the Expanded Metal & Corrugated Bar Company. The Ransome twisted and the old-style corrugated bars were covered with a thin coat of rust but free from scales of rust. The other bars were all fresh from the rolls and free from rust.

The concrete was hand-mixed with great care after the proportions had been accurately measured. The mixture was one part Atlas Portland cement, two of coarse sand and four of broken limestone, of $\frac{1}{2}$ in. and under, without dust. This was mixed to a fairly wet concrete, one that would easily enter the moulds and

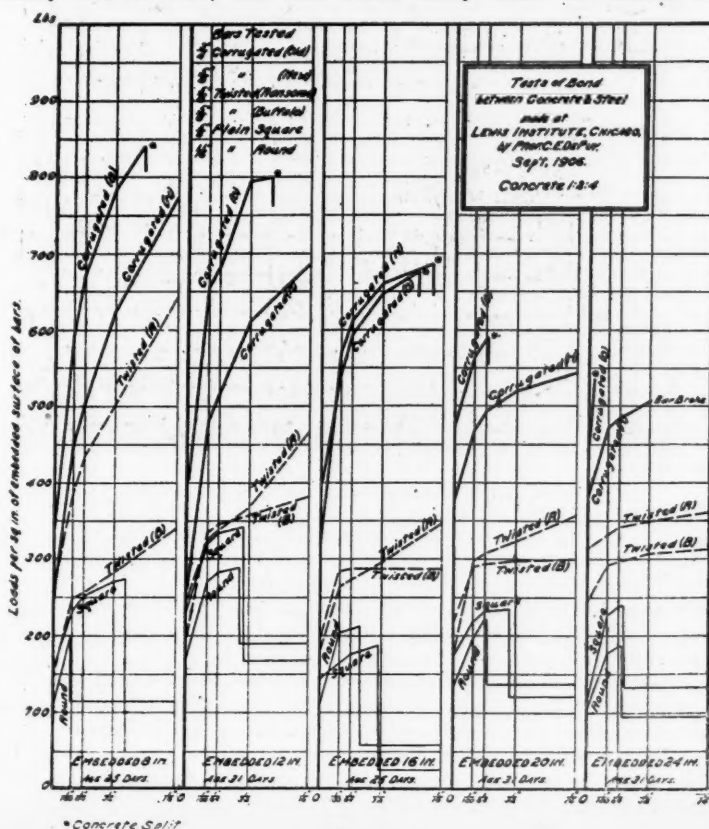


Fig. 3.

could be churned readily with a small iron rod. All the concrete used was mixed in one batch. The sheet iron forms in which the blocks were moulded were removed about one week before testing. The tests were made when the concrete was 25 days old for the 8 and 16-in. embedments, and when the concrete was 31 days old for the 12, 20 and 24 in. embedments.

Results of Tests.—The results obtained are graphically shown in Figs. 2 and 3 and are tabulated in Tables II and III. The diagrams show the results of all of the tests, with a maximum slip of $\frac{1}{16}$ in. Where the maximum load or stress on the bar was not reached within a slip of $\frac{1}{16}$ in., the curves would extend beyond the limits of these diagrams. In Fig. 2 the stresses or pulls on the bars are reduced to pounds per square inch of the cross-sections of the bars, while in Fig. 3 these stresses or pulls on the bars are reduced to pounds per square inch of the embedded surface of the bars. In Tables II and III the actual stresses on the bars with the corresponding slips are given, first in pounds per square inch of section of the bars, and second in pounds per square inch of the embedded surface of the bars. As there was no way of readily determining the surface areas of the Thacher bars, these are not included in Fig. 3 and Table III.

TABLE II.—RESULTS OF BOND TESTS.

Stresses on bars in pounds per square inch of cross-section.					
Embedment	8-in.	12-in.	16-in.	20-in.	24-in.
Slip not more than $\frac{1}{100}$ -in.					
Round	9,200	18,700	18,900	23,000	24,800
Square	11,900	24,300	16,800	28,000	35,200
Twisted (B)	12,700	25,400	28,800	36,500	44,300
Twisted (R)	19,400	24,600	26,000	38,300	50,600
Thacher	25,300	40,800	38,900	41,200	57,100
Corrugated (N)	23,800	37,500	60,000	61,500	74,500
Corrugated (O)	29,200	48,000	53,500	69,400	79,000
Slip not more than $\frac{1}{32}$ -in.					
Round	9,200	20,100	19,800	26,000	26,500
Square	13,900	26,200	19,300	30,800	37,300
Twisted (B)	14,400	27,100	29,100	37,900	46,700
Twisted (R)	25,400	27,800	30,000	41,700	53,400
Thacher	33,800	46,600	46,400	50,600	57,100
Corrugated (N)	33,000	48,400	69,600	68,400	80,000
Corrugated (O)	38,500	58,000	64,100	73,000	79,000
Slip not more than $\frac{1}{16}$ -in.					
Twisted (B)	17,300	29,000	29,200	38,400	47,600
Twisted (R)	32,600	35,400	35,500	45,300	55,100
Thacher	39,000	50,200	56,700	57,000	57,100
Corrugated (N)	40,700	54,200	72,300	72,500	80,000
Corrugated (O)	41,300	58,800	67,500	73,000	79,000
Slip not more than $\frac{1}{8}$ -in.					
Twisted (B)	21,000	32,700	31,500	39,900	48,300
Twisted (R)	39,000	42,800	43,100	51,300	59,500
Corrugated (N)	40,700	55,800	72,300	73,300	80,000
Maximum stresses on twisted bars with corresponding slips.					
Twisted (B)	43,000	57,000	52,000	64,500	71,000
Twisted (R)	$\frac{1}{16}$ -in.	$\frac{1}{16}$ -in.	$\frac{1}{16}$ -in.	$\frac{1}{16}$ -in.	$\frac{1}{16}$ -in.
Twisted (R)	41,800	58,200	56,900	81,000	68,500
	$\frac{1}{8}$ -in.	$\frac{1}{16}$ -in.	$\frac{1}{16}$ -in.	$\frac{1}{8}$ -in.	$\frac{1}{16}$ -in.

*Developed full strength of bond before slipping $\frac{1}{32}$ -in.
†Developed full strength of bond before slipping $\frac{1}{16}$ -in.
‡Developed full strength of bond before slipping $\frac{1}{8}$ -in.

TABLE III.—RESULTS OF BOND TESTS.

Stresses on bars in lbs. per sq. in. of embedded surface of bars.					
Embedment	8-in.	12-in.	16-in.	20-in.	24-in. Av'ge.
Slip not more than $\frac{1}{100}$ -in.					
Round	198	269	203	198	178
Square	232	316	164	218	229
Twisted (B)	250	334	283	288	291
Twisted (R)	382	324	256	312	332
Corrugated (N)	452	474	569	467	471
Corrugated (O)	594	651	545	565	578
Slip not more than $\frac{1}{32}$ -in.					
Round	198	289	214	224	190
Square	271	341	188	240	242
Twisted (B)	283	357	287	299	308
Twisted (R)	500	366	295	329	350
Corrugated (N)	626	612	660	519	506
Corrugated (O)	784	786	653	593	535
Slip not more than $\frac{1}{16}$ -in.					
Twisted (B)	340	382	287	311	313
Twisted (R)	642	406	349	358	362
Corrugated (N)	775	685	687	550	506
Corrugated (O)	840	800	687	593	535
Slip not more than $\frac{1}{8}$ -in.					
Twisted (B)	415	430	310	315	317
Twisted (R)	766	562	425	405	390
Corrugated (N)	775	706	687	556	506
Maximum stresses for twisted bars with corresponding slips.					
Twisted (B)	846	750	512	510	466
Twisted (R)	$\frac{1}{16}$ -in.	$\frac{1}{16}$ -in.	$\frac{1}{16}$ -in.	$\frac{1}{16}$ -in.	$\frac{1}{16}$ -in.
Twisted (R)	825	765	560	640	449
	$\frac{1}{8}$ -in.	$\frac{1}{16}$ -in.	$\frac{1}{16}$ -in.	$\frac{1}{8}$ -in.	$\frac{1}{16}$ -in.

*Developed full strength of bond before slipping $\frac{1}{32}$ -in.
†Developed full strength of bond before slipping $\frac{1}{16}$ -in.
‡Developed full strength of bond before slipping $\frac{1}{8}$ -in.

TABLE IV.—RELATIVE STRENGTHS OF BOND.

Relative efficiencies of the bars tested. From Table II, slip not over $\frac{1}{100}$ -in. Strength of bond of plain round bars taken as unity in each case.						
Embedment	8-in.	12-in.	16-in.	20-in.	24-in.	Av'ge.
Round	1.00	1.00	1.00	1.00	1.00	1.00
Square	1.30	1.30	0.90	1.22	1.42	1.23
Twisted (B)	1.38	1.36	1.55	1.59	1.79	1.53
Twisted (R)	2.11	1.32	1.38	1.67	2.04	1.70
Thacher	2.75	2.18	2.06	1.79	2.30	2.22
Corrugated (N)	2.60	2.00	3.18	2.68	3.00	2.70
Corrugated (O)	3.18	2.56	2.83	3.00	3.18	2.95

Relative Efficiencies of Different Bars.—In Table IV are given the ratios expressing the relative strength of bond, or efficiencies of the different kinds of bars as determined by these tests at the point where the slip did not exceed $\frac{1}{100}$ in., the strength of bond of the plain round bar being taken as unity in each case. From the results of these tests the greater efficiency of the bond of corrugated bars is very apparent.

Private Car for the Canadian Pacific.

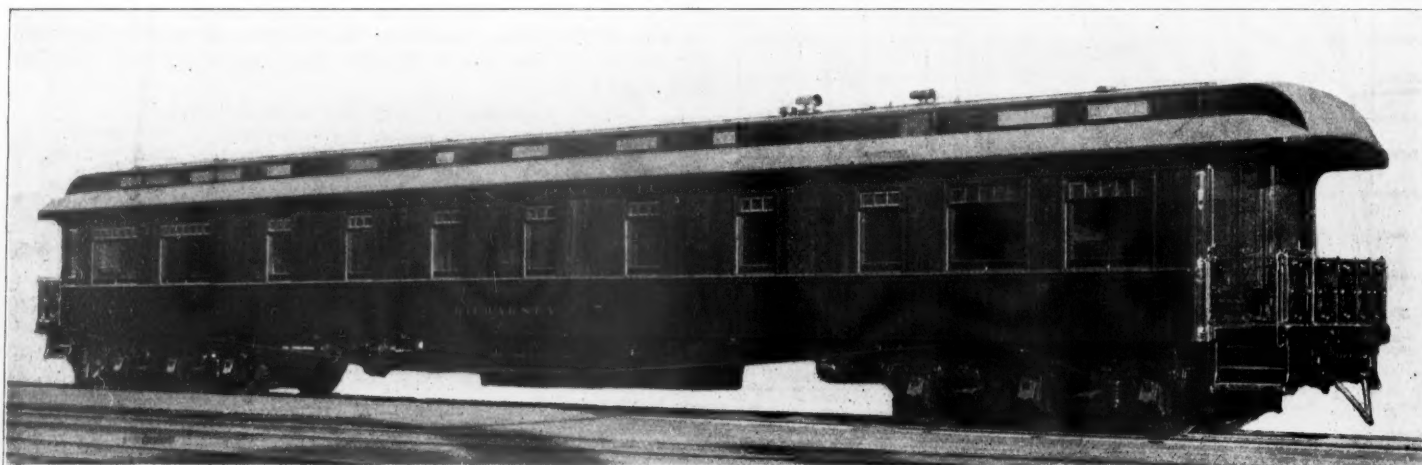
The Canadian Pacific has just turned out of its Angus shops a handsome private car, the "Killarney," for the use of the President, Sir Thomas Shaughnessy. The interior of the car is marked by the entire absence of ornamentation and the studied plainness of the finish. The exterior is finished entirely in mahogany, Canadian Pacific standard ornamentation being used.

The car is very long, being 74 ft. over the frame, and 84 ft. 3 1/4 in. over the buffers. At the rear end is a large observation platform, recessed into the body of the car for 2 ft., and surrounded by a heavy railing slightly relieved by polished brass ornamentation. The observation room is 14 ft. long by 9 ft. 8 in. wide. The walls are finished in selected Circassian walnut. The Empire ceiling is finished in stained birch, to suit the lighter tones of the walnut. The deck-lights are in art glass to harmonize with the woods and appointments. The observation windows are unusually large, those at the

being in white porcelain with nickel plated fittings. Next to the lavatory is a small room for heavy coats and small hand baggage. Next to this comes the president's bedroom, 8 ft. 6 in. long by 6 ft. 9 in. wide. The woodwork is finished in ivory white, the walls being paneled in red silk, with curtains at the window of silk to match the panels. The room contains a plain brass bedstead, at the head of which is a small table with drawers. On the opposite side of the room is a wardrobe and a dressing table with drawers underneath. The carpet is a heavy Wilton of a shade harmonizing with the curtains and panels.

Opening off this room is the bathroom, which also communicates with the passage and the next bedroom. This room has porcelain bath and washstand with nickel plated fittings, the floor being covered with small mosaic blocks. The walls from the floor to the cornice are covered with white enameled tiles, and all exposed woodwork is finished in ivory white.

The second bedroom is finished practically the same as the



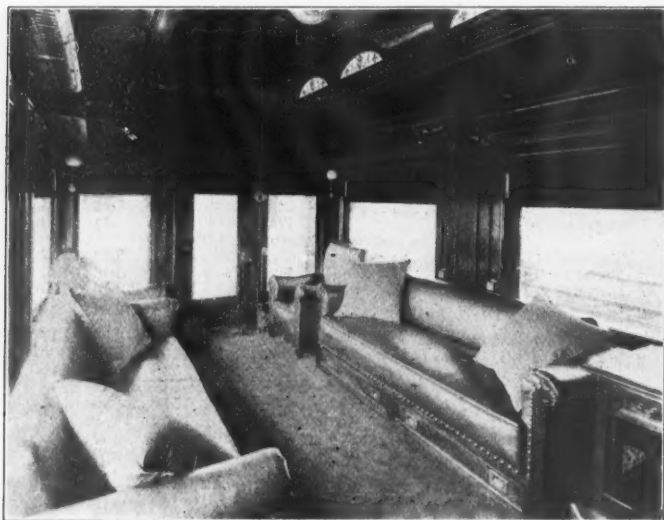
Private Car "Killarney" for the President of the Canadian Pacific.

rear being 5 ft. by 2 ft. 3 in., and those at the sides 5 ft. wide and 2 ft. 6 in. high. One of the features of this room is an ingenious spring roller map rack which is placed in the upper part of the bulkhead of the car and runs transversely. By the release of a lever the map rack moves out from the bulkhead so that any one of the maps may be pulled down for examination. By means of the same lever, the map rack moves back into the bulkhead flush with the other woodwork. The room is furnished with two heavy wire backed armchairs, and two sofas which at night may be turned into beds, all upholstered in dark green leather. There is also a

president's room, except that the panels, curtains and carpet are blue.

Next to this bedroom is the secretary's office and bedroom. This is intended for the president's secretary, but it can also be used as an additional stateroom if required. It has a sofa, which at night can be turned into two berths, upper and lower, porcelain washing conveniences, cupboards overhead both at the front and rear ends of the room, and a handsome desk, having a bookcase above, the doors of which are fitted with leaded glass windows. The finish of this room is entirely mahogany.

The porter's room is immediately next to this, but the section



Interior of Observation Room.

small writing table and chair at the forward end of the room, both of which are walnut. The carpet is a heavy Wilton, of a rich green shade with a small artistic design.

A corridor, paneled in mahogany veneer, extends from the observation room to the dining room at the opposite end of the car, and runs past the intervening rooms. This corridor is roofed over flat, the space between the roof of the corridor and the ordinary roof of the car being used for lockers, which are reached from the various rooms. This arrangement adds to the storage accommodation of the car and to the appearance of the passage itself.

A general lavatory comes next to the observation room. This is finished in ivory white with mosaic tiled floor, the appointments



President's Room With Bath Connecting.

of the car just described is divided from the remainder by a swinging door in the passage to prevent draughts. This room contains two berths, folding washstand and water closet, and is plainly finished in mahogany and green leather. All the rooms are amply supplied with basket racks, coat hooks, etc., of a finish to match the rooms.

The kitchen car, which also serves the purpose of a pantry, is completely fitted up with cupboards for the silver, glass and china-ware, drawers for the knives, forks, spoons, etc., refrigerator, working table and sink, a steel range of the latest design, and a coal bin. The walls of the kitchen are finished in white enamel tiling, while the woodwork is of mahogany.

Next comes the dining room, 12 ft. 8 in. by 10 ft., finished in mahogany veneer, and decorated with a simple marquetry design. The mahogany dining table will seat eight people comfortable, and ten at a pinch. The upholstering of the sofa and chairs is of dark green leather, and the floor is covered with a heavy Wilton carpet of a rich green color.

The car is lighted with electricity and also the Canadian Pacific standard system of acetylene gas. The fixtures, however, are so arranged that the gas can only be turned on by a special key in the hands of the porter, so as to prevent the gas from being unnecessarily wasted.

A Plan to Relieve Car Shortage and Congestion.

The following letter, giving what the writer believes to be the chief causes of the present car shortage and congestion, and suggesting a method for determining the truth of his assertions, was addressed to the Interstate Commerce Commission by Mr. Russell Harding, to whom we are indebted for this copy.

New York City, Jan. 7, 1907.

INTERSTATE COMMERCE COMMISSION, WASHINGTON, D. C.

Gentlemen.—Herewith I hand you an analysis specifically for the relief of car shortage and congestion. In various mediums during the past 30 days interesting articles have appeared appertaining to the question of car shortage as experienced throughout the United States. The question appears to be discussed from two viewpoints, one side claiming that the car supply is ample, but that track facilities are wanting. The seeming want of additional track facilities is susceptible of much discussion and consideration. It would seem, from long experience in the transportation business, that there is a point which has not been given the proper consideration by either the public or the transportation companies; and to the writer it is the true cause, if not wholly, at least to a very large extent, of the present congestion, and the inability to handle freight promptly to destination.

We will consider the question from the situation, say, in 1898, when business conditions began to change by the volume of business increasing steadily each year in all branches, up to the present time. At that time (1898) shortage of equipment was unknown to any degree for the reason that the volume of business from the various industries throughout the country was only equal to the facilities as provided by such industries themselves, or otherwise.

With the immense increase in business that has developed there has been practically no increase in industrial tracks; consequently the transportation companies have been forced, in order to care for such increase in business, to expand, and expend enormous sums of money increasing their yards at all important points in order to hold the cars awaiting delivery to industrial concerns; and there seems to be no end to the expansion in this direction, until further facilities are provided by individuals or industries.

Let us see how this works out: Dating from the time mentioned (1898) it was possible to satisfy the industries by switching to their plants cars for unloading, and taking therefrom cars as loaded; say one, two or three times each 24 hours. By the increase in business gradually each year the same plants require switching service three, six and eight times daily, in order to keep up, or to attempt to keep up, with the increase; and it is the exception rather than the rule that additional or enlarged facilities have been provided by such industries, thus requiring the transportation companies to perform many times the service in switching, and to increase their terminal yards to permit the large accumulation of cars to be stored therein, caused by the failure of the industrial plants to handle their materials without continuous service of the switch engines, occasioned wholly by inadequate industrial switching tracks.

Further delays are caused by the necessity of transportation companies being compelled to work, or switch out of their enormous holding yards certain specified cars that may be wanted by the industries in preference to others containing, say, certain kinds of material: when the same concern may have large numbers of other cars being held for unloading in said yards and which are more conveniently placed for switching.

From information gathered, the assertion is here made that in all large business centers 90 per cent. of all the cars that are held—and I do not believe that there is an important point but will show the yards of the transportation companies filled to their utmost capacity—are for delivery to industries and business interests at such points, and the transportation companies are unable to quickly or properly deliver such freight on account of inadequate industrial and team track room. By being "unable" is meant a physical impossibility to perform the work owing to crowded conditions in the holding yards. Therefore, instead of transportation companies being able to get from the total cars in their service from 28 to 40 miles per day movement—such results being obtained eight years ago by prompt loading and unloading of cars—they are now showing

a movement of only 16 to 22 miles per day for the total numbers of cars in service, thus requiring the addition of a larger number of cars to perform the same business in tons handled.

At division points of the transportation companies enormous expansion and expenditures of money have been made yearly during the period in question, the necessity being wholly for the purpose of storage yards resulting from the congested condition of delivery yards at destination of freight. Thus we account for the slow movement from originating station to destination. Originating centers must be cleared daily, or practically so; hence freight is moved out and cut off at intermediate points owing to the fact that the final destination points are blocked with freight awaiting delivery as set forth above.

Since the question has become so serious as to attract the attention of the Interstate Commerce Commission and the different state commissions, would it not seem wise to consider the question by dissecting the whole situation so that the true cause may be shown that is responsible for the present conditions?

I have stated that much of the trouble comes from insufficient industrial tracks—meaning such tracks as are not owned, or controlled, by the transportation companies. I think fully 75 per cent. of the trouble is chargeable to this cause. It would not be difficult to determine this, if I might offer a suggestion, which would be as follows: Cause each system of railroads of any magnitude to prepare blueprints of all tracks as owned by them and over which they exercise control, including all large centers and division points; in fact, tracks of every nature outside of main tracks, say as of January 1, 1898, and the same on January 1, 1907. This information can be produced by all roads, as such records are generally kept up very closely. From such blueprints can be determined what tracks the railroads had on January 1, 1898, with which to handle their business; and also what additional tracks have been put in up to January 1, 1907; also the car capacity of such tracks at each date. And from said blueprints the industry tracks will also be shown and their car capacity. In this manner an accuracy of condition will be shown.

If the industrial tracks that are not owned by the transportation companies do not show an increase in proportion to the increase in holding tracks and yards put in by the transportation companies, then it would seem that the transportation companies have been forced to add track facilities for individuals and industries, and also forced to stand the very heavy expense of additional switching and handling of cars.

After the above conditions have been shown, a further proof of the true conditions may be had by the work of the auditing departments of the various selected systems. Cause to be shown by carefully compiled statements the tonnage handled in and out for the various industries during the year 1897, and the tonnage handled during the year 1906, by the same lines and for account of the same industries. The per cent. of increase shown can be compared with the per cent. increase of tracks put in by the railroad companies and by the industries.

Further, as the records of the transportation companies are kept, each 24 hours a report is made showing the total number of loads and empties to move, east, west, north and south; the number of loads and empties in trains in transit, and the number of loads waiting to unload at each and every station on the road. A glance at such reports for a few consecutive days will clearly show the conditions and give an accurate idea of the situation and what causes congestion and slow movement of freight.

So far as the ability of any of the great systems for handling the business over their main lines is concerned, this can be shown beyond doubt, if the freight so handled can be taken care of at destination promptly; but under present conditions slow movement is experienced by the very crowded conditions in all yards, and the blocking of passing tracks with cars held out.

Railroad companies, in order to prevent charges of discrimination by failure to move freight, are compelled to change the consist of their trains at almost every division point for the purpose of showing their endeavor to move the vast accumulation bodily daily if only for the distance between division points, which causes an expense of switching at each point, as well as taking up the time of locomotives that would otherwise be used in moving cars on the main line towards the destination of the freight.

Touching on the subject of insufficient equipment, the explanation first mentioned shows where it is necessary to provide 75 per cent. more cars to move the same volume of freight, less the increased capacity of the modern car.

After the conclusions have been reached locating the fault for slow movement, or more properly non-delivery, it becomes a very serious question to determine which of the two interests should shoulder the burden. It may be claimed that the railroad company should provide tracks for industries, or business interests, as they do for local freight houses and what are termed team delivery tracks. It has not been the custom so to do, but it may be that such might be the ruling, providing that individual interests furnish the right of way.

RUSSELL HARDING.

Railroad Refrigeration.

BY JOS. H. HART, PH.D.,

Randal Morgan Laboratory of Physics, University of Pennsylvania.

The problem of refrigeration is daily becoming of increasing importance in railroad management. The amount of perishable freight which is transported in this country is increasing by leaps and bounds, and the end is not yet in sight. The problem of protecting this freight by suitable refrigeration while in transit has not yet been satisfactorily solved. The advent of mechanical refrigeration as a practical process into the engineering world has developed hopes of its utilization in this field which have not yet been realized, but it is not evident that this is the fault of mechanical refrigeration. Artificial refrigeration is able to produce to-day ice in large quantities at less than 50 cents a ton, and to produce refrigeration equivalent to the melting of ice at a much less rate. In spite of these facts, the good old-fashioned method of icing cars is still commonly in vogue, and although there exist a number of other methods more or less adequate and satisfactory in their work, they have not found general use. Daily, almost, new patents are taken out for refrigerator cars and refrigerator car apparatus, but none of these seem to be entirely satisfactory. The fact of the matter is that railroad refrigeration has not been approached in any sense as a broad engineering problem. The field is open and a large amount of individual work in small details has been accomplished, with very unsatisfactory results.

The problem of satisfactorily cooling cars while in transit is no more difficult than that involved in cooling any similar space for equal intervals of time. In spite of this, the whole situation is undeveloped and extremely unsatisfactory. We have to-day the ordinary method of dumping natural ice into cars, and this ice is collected along the railroad at regular intervals in houses provided for storing the same. The variation of this method consists in artificial production of ice at stated intervals by refrigerating plants, and its storage and installation in refrigerator cars. The development of individual refrigerating machines for single car units has been attempted without appreciable success. The number and variety of the devices with this object in view are innumerable. A majority of such devices depend upon the motion of the car to produce the operation of the refrigerating plant, and are therefore subject to considerable disadvantage. The same problem applies to the electrical lighting of passenger coaches by dynamos attached to the axles of the cars, a method which has been found very unsatisfactory in practice. When the car stops, light stops, unless a large and expensive storage battery is installed, and the system of switches required for automatically changing the current is no inconsiderable item. The same difficulties apply in the unit refrigeration by mechanical means. When the car stops refrigeration stops, and this is often sufficient to prove a great danger to perishable goods in transit. The difficulty can be obviated, of course, by the use of brine storage tanks to store the refrigeration and use when the car is not in motion, but this is unsatisfactory for the same reasons that storage batteries are undesirable in lighting systems.

The problem of cooling the car by direct refrigeration instead of the utilization of ice has been solved in one or two minor instances where the refrigeration required is not extreme. As an illustration, bananas are now carried in bulk for several days with cooled air injected into the cars at suitable cooling stations along the route. This involves the use of large mechanical refrigerating plants and the cooling of large quantities of air. This air is blown into the cars under slight air pressure and rapidly cools them and their contents. The fruit is cooled sufficiently to be carried for several days without re-cooling, the amount of heating which takes place depending upon the temperature and moisture in the atmosphere. The chief difficulty in this method of refrigeration is the production of sufficient ventilation to keep the goods in good condition without large losses in refrigeration. In the banana trade this seems to be satisfactorily solved. The temperature of the bananas need not be lowered very much, and can rise quite high without causing deterioration. Thus the range is considerable and the quantity of heat taken out of the car, which is returned by radiation and ventilation, is large in proportion to the bulk of the cargo.

This process, however, cannot be extended to any great extent by the air process without tremendous losses from an efficiency point of view and without the ever present possibility of considerable damage resulting from overheating. It can be stated at the outset that refrigeration of cars by unit refrigerating machines installed in the cars and operated either by the motion of the car itself or by power received from the engine, is impracticable not only from a first cost point of view but also on account of its very small efficiency. Thus all the attempts to produce refrigerator cars complete in themselves is necessarily an uneconomic process, and one that almost invites failure from its very nature. The problem of utilizing cold air is acceptable and satisfactory with certain limitations necessarily involved in the nature of the process and

the nature of the cargo, from the standpoint of amount of ventilation required, quantity of the refrigeration involved in the cargo and temperatures desired. As an illustration of this latter point, meat cold storage requires considerably lower temperature than that of many fruits. It would be almost impossible to maintain a temperature of 35 or 40 degrees in a refrigerator car with cold air for any appreciable length of time owing to the very small quantity of refrigeration held in the air itself and the fact that the low temperature would promote rapid radiation.

The only method in which this problem can be attacked satisfactorily is from a broad engineering point of view, paying attention not only to the needs of the railroad but also to the limitations of the various refrigerator processes. Apparently the only limitations of the railroad are: first cost, convenience of operation and minimum space. From a refrigerating point of view the limitations involved are necessarily small units with small quantities of heat used in the process, fairly low temperatures occasionally, and necessary ventilation with its accompanying losses in refrigeration. Now mechanical refrigeration is able to exist economically under some circumstances in stationary units smaller than that of a refrigerator car. Small one and two-ton refrigerating machines exist and operate at a distinct economic advantage both from an efficiency and convenience point of view in considerably smaller units than that required for refrigerator cars, so that this latter statement explains to a certain extent the large amount of work done at present in attempts to install single automatic refrigerating machines in separate cars. The process of air cooling as now used in the banana trade, with refrigerating stations instead of ice houses at stated intervals along the route, is thoroughly practical and very efficient and is capable of considerable expansion. The entire problem, however, of railroad refrigeration can only be approached satisfactorily with a complete knowledge of mechanical refrigeration and its limitations. Mechanical refrigeration is an economic process to-day with two different processes. Both of these, however, involve the boiling of liquid ammonia. They are known respectively as the compression machine and the absorption machine. For extremely large units the absorption machine is much more efficient than the compression machine, although in small units the compressor holds its own fairly well on account of smaller first cost and ease of operation. However, it should be borne in mind in railroad work that refrigeration can be produced much cheaper in large quantities and that the absorption machine is much superior in efficiency to the compression machine. But the absorption machine is so complex in its operation and requires so many different units and so much care in its maintenance that no automatic absorption machines have ever been built. This eliminates the possibility of utilizing small units of mechanical refrigeration in cars if any consideration at all is given to the production of refrigeration and the efficiency of this process.

Refrigeration when it is produced—and, as we have stated, it can be best produced in large plants by the absorption machine—can be utilized in a number of different ways, each of which offers special different advantages depending on the immediate application of the refrigeration. Thus, in ship refrigeration, which is somewhat analogous to railroad practice, air refrigeration has been used. The reason for this, however, is largely the possibility of ammonia gas escaping and injuring the product as well as rendering the ship uninhabitable. Direct air refrigeration by balanced expansion has a prime cost factor three times as great as that of ammonia expansion and from an efficiency point of view in operation is scarcely half as high as that of an ammonia plant. Air cooled by contact with ammonia pipes, however, is often used in both cases and presents one of the possibilities of railroad refrigeration but has a number of limitations.

Now refrigeration produced in ammonia machines can be utilized in a number of ways. There exist what is known as direct refrigeration and indirect refrigeration. The indirect refrigeration requires the use of brine as an intermediary in the utilization of the cold. The reason for this is purely mechanical. Ammonia pipes carry the ammonia under pressure and are sometimes subject to chemical action and leaks of the ammonia gas are not only undesirable but often injurious to the goods in the refrigerator. In practice, brine is ordinarily used, and the pipes carrying the ammonia occupy a small space and cool the brine, which is made to circulate wherever wanted. The advantage of the brine system is that brine can be used as a storage reservoir; that is, a large quantity of brine can be cooled off by the machine, the machine can then be stopped and the cold brine can be circulated through the system, producing refrigeration just as if the machine were in operation, and the cold brine, which has a large heat capacity, becomes hot very slowly, so that in some cases the machine may be stopped for several days without a very appreciable rise in the temperature of the refrigerating coils.

Thus, when we consider mechanical refrigeration from a general point of view, the development of its application to railroad refrigeration is at once almost self-evident. The production of ice in individual plants by the use of the brine is not only wasteful

and inefficient but is absolutely unnecessary. The brine itself can be used and possesses large heat capacity. Injected into refrigerator cars it could be used in pipes or in a narrow tank about the walls or at one end of the refrigerator car, and the system could be arranged so that less space would be taken up. The possibility of having single tank cars carrying nothing but cold brine connected with pipes through the various cars and operated from the locomotive very much as the modern air-brake system is utilized presents a possibility which from an efficiency point of view is far superior to the methods now in vogue. Brine tanks could be in-

The New Union Station at Lexington, Kentucky.

A new Union station is now being built at Lexington, Kentucky. It is to be ready for use within two or three months. The accompanying illustrations are made from the original sketches for the building; for them we are indebted to Richards, McCarty & Bulford, Columbus, Ohio, the architects. This station is to be used for the Chesapeake & Ohio, the Louisville & Nashville, and the Lexington & Eastern railroads, the latter a 93-mile line from Lexington east to Jackson, Kentucky. It is being built by the Union Station Com-



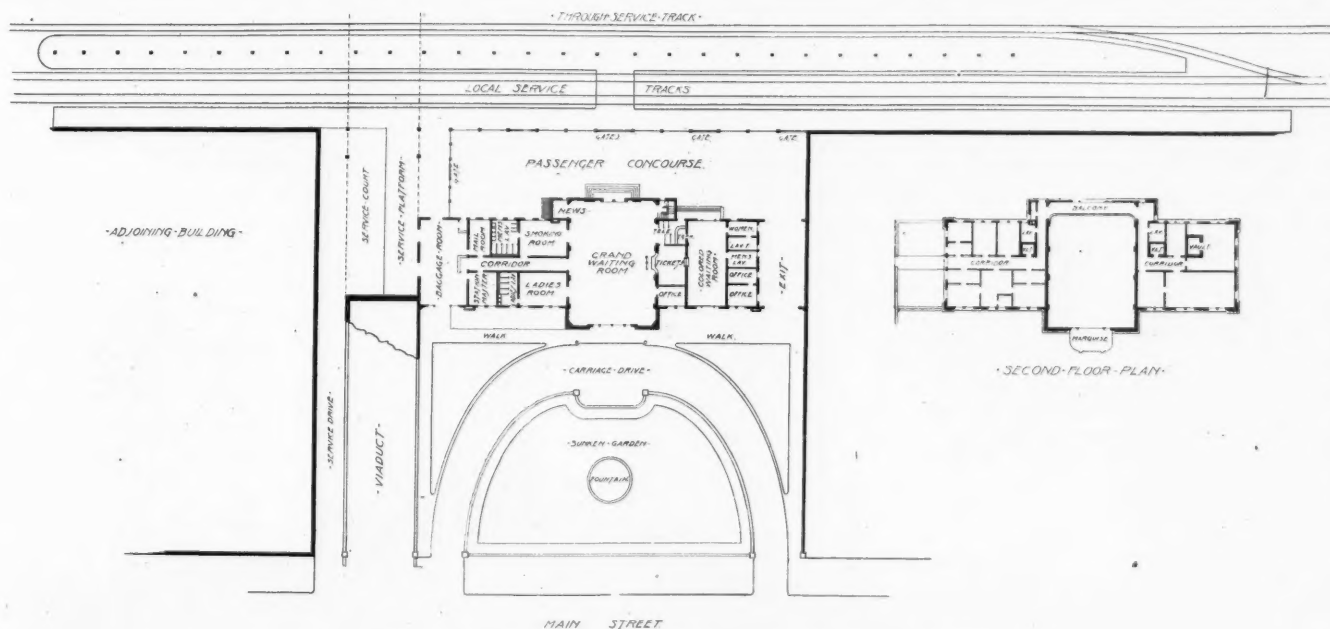
Architects' Sketch of New Union Station at Lexington, Kentucky.

stalled under the cars and filled at stated intervals, and automatic devices constructed readily to show when the temperature rises above the danger point. The brine could then be renewed at suitable stations in exactly the same manner as the Pintsch gas tanks are refilled. This process would involve a saving not only from a refrigerating point of view in the operation of the refrigerating machine and the elimination of the production of ice as at present used, but the refrigeration could be produced in extremely large units and the brine transported either in cars or by pipes to other suitable distributing stations.

This plan is so sensible and involves such a large saving in

pany, in whose ownership and management each of the railroad companies have representation.

The site is a central and convenient one about two blocks from the business center of the city, fronting 265 ft. on Main street and extending back 240 ft. from Main street to Water street, on which are the tracks of these three railroads. The station fronts on Main street, which is toward the north. On the east is an alley 16 ft. wide marked "Service Drive" on the drawing. Between this alley and the station 40 ft. has been reserved for a viaduct from Main street, running past the east end of the station, over the railroad tracks, and connecting with High street, the first street south of



Plan of New Union Station at Lexington, Kentucky.

almost every department extending from the production of the refrigeration to its handling and the saving of space and its transportation, that it seems remarkable that this process has not been developed before. There is no doubt that it will be developed as soon as capable engineering experts take charge of the problem, although such men must be capable not only from a refrigerating standpoint but from a railroad standpoint as well.

In conclusion it can be stated that the present methods are absolutely inadequate and extremely inefficient, and the developments that are now going on in the line of individual refrigeration is an attempt to solve the problem along wrong lines.

Water street. The grade of this viaduct is such that there is entrance to the second floor of the station from the viaduct level; this for the benefit of the offices which are to be on that floor. The space next to the station under the viaduct is to be used for service wagons; no baggage, mail or express wagons are to be allowed to enter the court in front of the building, which is reserved for carriages.

The station building itself stands about 150 ft. back from Main street, leaving a large court in front enclosed on three sides by the station, the viaduct wall, and on the west an ornamental wall built against an adjoining building. From each corner of the front court

to the main entrance of the grand waiting room, the space between this carriage drive and the street is to be a sunken garden with fountains, flower beds and shrubbery. The entrance to trains will be either through the main waiting room or through the waiting room for colored people. Passengers arriving on trains need not pass through these waiting rooms, but can go out to the street through an open passage at the west end of the station. In this way passengers are entirely separated from the baggage, express and mail end of the station.

The passenger concourse between the station and the tracks is 50 ft. x 220 ft. It is roofed in and protected from the weather, and lighted and ventilated by skylights. In order to handle crowds effectively the passenger concourse is enclosed with a high iron fence which allows entrance to the train platform only through the gates, where shown. The inside track platform, next to the passenger concourse, is 14 ft. wide. There are three tracks, two for local service, and the outside one for through service. The platform between the through service track and the local service tracks is 20 ft. wide. It has been attempted to avoid columns in these platforms as much as possible. These two platforms are together 700 ft. long. Butterfly roofs are used instead of the umbrella shed, thus throwing all the water from these roofs toward the center from which it is carried down each of the columns to the sewer connection instead of throwing the water to the outside next to the cars.

On the ground floor of the station in the center is the grand waiting room, which is 50 ft. x 72 ft., and has a barrel arch ceiling 55 ft. high at the center. This room is lighted, not only by the two large arches at each end, but by art glass ceiling lights. The waiting room for colored people is 22 ft. x 48 ft. The ticket office is between the two main waiting rooms, thus serving both white and colored passengers, but keeping them entirely separate. On the opposite side of the grand waiting room from the ticket office there is a smoking room for men and ladies' waiting room. Between these two rooms a 10 ft. corridor leads from the grand waiting room to the baggage room, so that it is not necessary for passengers to go outside to check baggage. As the Phoenix Hotel adjoins the property no provision was made for a restaurant or eating room in the station.

The second story of the building is used for the general offices of the Lexington & Eastern. This space is, of course, only in the two wings which are connected above the main waiting room by a balcony at the south end. The building is made of fireproof construction. The material for the exterior is a rough orange mottled brick, trimmed with terra cotta. The roof is Spanish tile. On the first story all floors are marble and tile. The wainscoting is of white marble, the wood finish, doors and windows throughout are of quarter-sawed oak.

The New Cincinnati Freight Terminal of the C., N. O. & T. P.

The proposed new freight terminal of the Cincinnati, New Orleans & Texas Pacific at Cincinnati, Ohio, to be built by the lessor company, the Cincinnati Southern Railway, was described and illustrated in detail in this journal something over a year ago (*Railroad Gazette*, September 29, 1905). The plans provided for a thoroughly up-to-date large-city terminal on an entirely new site much nearer the business district of the city than the terminal then in use, and

which was acquired at considerable cost, the sum exceeding \$1,300,000. The work suffered considerable delay and was not finished until the fall of 1906. A photograph of the terminal taken from the corner of Vine and Front streets is presented herewith. It shows the office portion and the inbound freight house, the great length of the latter—1,142½ ft., almost a quarter of a mile, from Vine street to the west end—causing the farther end to dwindle to indistinctness in the view.

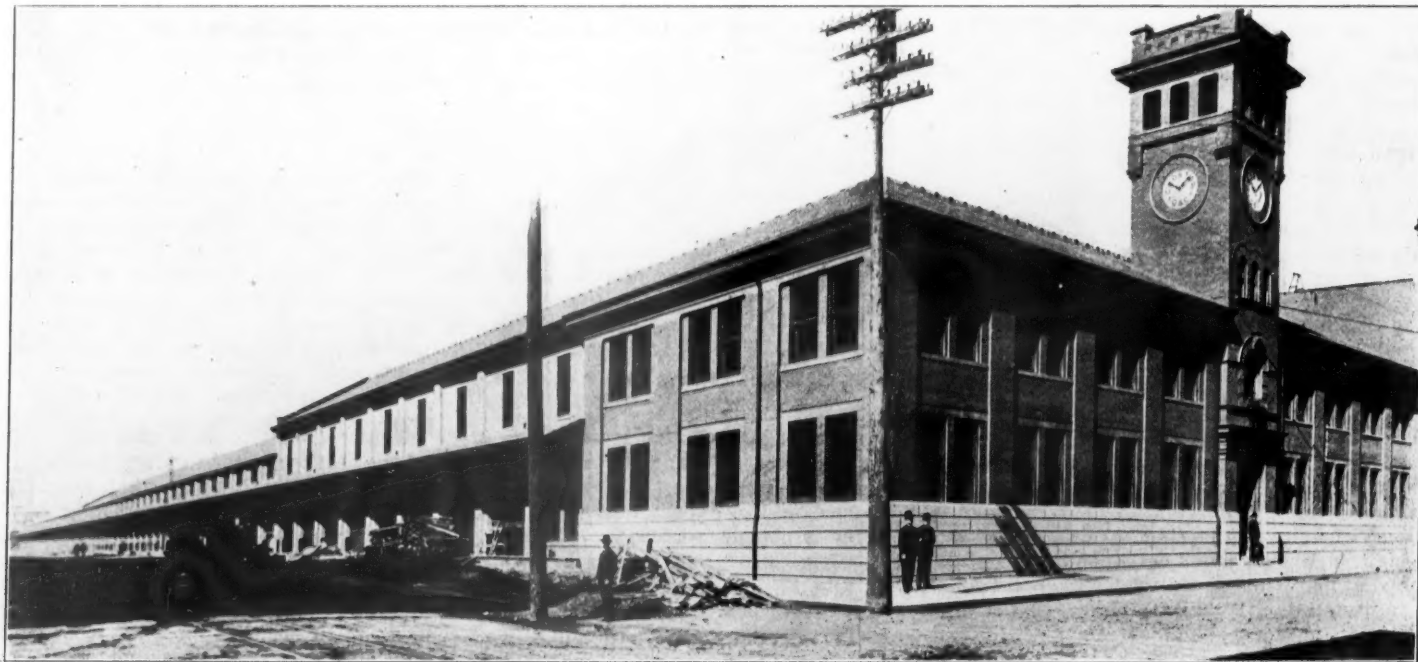
The office part is 130 ft. front by 45 ft. deep and the two freight houses are each 1,000 ft. long. The outbound house is 42 ft. wide and the inbound house 25 ft. wide. Each has a two-story portion 135 ft. long adjoining the office building for record rooms for the general offices of the railroad company. The entire structure is built principally of reinforced concrete. The office portion has steel roof trusses and tile roof and the concrete walls are faced with pressed brick with stone trimmings. The freight houses have wooden roof trusses and tile roofs, and the walls are without the brick veneering, having instead a plaster finish on the concrete surface.

The freight house tracks have room for 81 cars. The capacity of the new outbound house is double that of the former quarters, while the inbound house capacity was increased six times. The work was begun under the late Col. G. B. Nicholson, who was Chief Engineer of the C., N. O. & T. P. and Chief Engineer and Superintendent of the terminal work for the Trustees of the Cincinnati Southern. It was completed under Mr. H. E. Warrington, the present Chief Engineer, who as Principal Assistant Engineer, took charge of the department when Colonel Nicholson was relieved from active duty on account of failing health.

Government Investigation of the Terra Cotta Collision.

On Monday of this week the Interstate Commerce Commission resumed its hearings on the rear collision at Terra Cotta, D. C., December 30, in which over 40 passengers were killed. We continue from our last issue the report of the evidence.

W. N. Dutrow, block signalman at Silver Spring.—I am spare signalman for the Baltimore & Ohio. My home is at Boyds, Md. Am 22 years old, and Boyds has been my home for the past five years. In 1905-06 I was agent and operator for the Atlantic Coast Line in North Carolina, mostly at Oak City. My wages there averaged \$46 a month, including commissions on the express business. I learned telegraphy in 1903 under the agent at Boyds. Was in the office with him every night for six months. On the Atlantic Coast Line I was examined by the despatcher at Tarboro. After a year on that road I returned voluntarily to Maryland so as to be near home and to get an eight-hour job. I was examined very briefly by the division operator. He told me to post up on the block-signal rules. I did so, and after ten days went to work at Rockville. This was in October last. I worked there and at other stations five days in October, 12 days in November and 16 in December. I was at Silver Spring three nights before the collision. The pay there is \$48 a month. The hours of operators in Maryland are eight hours, but some agents perform other duties before or after the eight-hour period, so that they are on duty altogether 10 or 12 hours. The only special instructions I received at Silver Spring were from Miss Harrington, the regular operator from 4 p. m. to midnight, who



New Cincinnati Freight Terminal of the C., N. O. & T. P.

took a vacation for the holidays, that the "double green"—meaning the green lantern to be used in connection with the green semaphore light to give a permissive signal—was to be hung out every night and kept there from 7:00 p. m. to 6:30 a. m. The helper at Silver Spring is 70 years old and receives \$20 a month.

The double green is shown to every eastbound train at Silver Spring during the night, so that the cross-overs at Terra Cotta and at University may be used by westbound trains at any time. I know of no printed rule covering this matter. (It appears that certain eastbound night passenger trains are scheduled to run from Silver Spring to University and beyond at 60 miles an hour and faster. As the road has a number of curves, the caution signal would apparently make it impossible for these trains to make their schedule time.) Asked whether there was a distant signal at Silver Spring, witness apparently had never heard of such thing as a distant signal.

Train No. 6, eastbound, passed my station December 30 at 4:43 p. m.; No. 66 at 6:21 p. m., and extra 2120 at 6:28. I gave white (all-clear) to both 66 and 2120. The latter was running at about 20 to 30 miles an hour. I saw the white signals on the engine. About 6:33 p. m. Takoma informed me that 2120 had passed his station at 6:31.

Engines have run by my red signal perhaps 50 yards. I know of no inspection as a check against this irregularity. The first I heard of the collision was through the messages passing over the wire ordering out relief trains. I spoke with nobody about the signal at my station, except that the agent at Boyds, an old acquaintance of mine, asked me what signal I had given to 2120 and I told him white.

Asked if he had had any controversy with the despatcher that night, witness said he had not. About seven or eight o'clock the despatcher wanted him to call Day Operator Burns. After a second notification, Burns came to the office but refused to work. The despatcher seemed to think that I had not properly handled his orders, but I had done nothing wrong. Operator Feeney was in my office about 8:00 p. m. and, being near the blanks, received a message for me.

Q. Were you excited about the collision? A. I was perfectly calm. I stayed on duty until midnight. Q. The men on trains 66 and 2120 say that you gave them the double green signal; is that true? A. It is not. Q. If you had given double green and it was wrong to do so, would you tell the truth about it? A. Yes, for even if I had given such a signal the engineman would be at fault for accepting it, because it would be his duty to stop and inquire the reason for the display of an improper signal at that time (before 6:30). Q. Why should the men of trains 66 and 2120 declare that they received double green at your station if the signal was really white and they knew it to be so? A. To support their untruthful story that the responsibility rested on me. (Taking the witness' assertion as true, that the signal showed white, his opinion here rests on the assumption that Vermilion, the engineman of No. 66, testifies "double green" so as to support Hildebrand, the engineman of 2120; that Hildebrand either did not see the signal, or saw it white; and that each fireman corroborated the testimony of his engineman as a matter of course.)

C. E. Remsburg.—I am signalman at University. Am 35 years old and have been a telegraph operator 15 years. I learned during two years that I acted as mail carrier. Have been at University as block signal operator 7½ years. My examination for that position was by Mr. Little, division operator. It took about 20 minutes. My pay is \$55 a month, about five dollars more than it was two years ago. I learned of the collision at 6:45, the conductor of No. 66 reaching my office on foot at that time. For all eastbound trains I display a green signal, my station being near the terminal yards at Washington. A double green would mean substantially the same as my signal, as it requires a train to run under control the whole length of the block section. (It appears that though green is given for every train, passenger trains are not allowed to follow other trains under green signals until the last preceding train has reached the next block station, except on an order from the despatcher.)

Miss Marguerite Harrington.—I have been block-signal operator at Silver Spring since last October. Before that I worked two years on the Illinois Central. I was examined by the division operator; was tested as to my proficiency as a telegraph operator and also on the rules. I work from 4:00 p. m. to midnight and do nothing but block-signal work, there being a station agent who attends to the ordinary station work. Operator Dutrow, who was taking my place on December 30, had been there once before. At that time I had told him that the double green was the signal given to all trains from 7:00 p. m. to 6:30 a. m.

Takoma sometimes closes as early as 6:20. Q. Suppose No. 66 received a double green at Silver Spring at 6:21, what should the engineman do? A. On either a single green or double green, he would run under control to Takoma. I understand that single green and double green mean virtually the same thing. Q. Do you give permissive signals to passenger trains frequently? A. Perhaps twice a week. No. 66 would have no right to assume from seeing a double green before 6:30 that Takoma was closed.

Engines have passed my red signal a few hundred feet, but never farther than that. In case of sickness, block-signal operators have in one or two cases worked 16 hours continuously. I have worked 12 hours on one occasion. On the Illinois Central I worked controlled manual, single track. I feel safer here, under the "telegraph block," as we use the telegraph, while on the I. C. we used the telephone, which was confusing. Asked whether the telegraph block system would be better than the controlled manual on the Illinois Central, witness was not prepared to compare single-track with double-track working.

J. W. Kelly, Jr., trainmaster, was recalled and testified at length concerning the hours of freight trainmen, as shown by the records for the months of October and November. Certain night crews worked 14 hours, 22 hours, and in one case 36 hours; this crew's work was more night than day. Another crew worked 20, 19, 19, 21, 19 and 21 hours daily; another, 22 hours, 21½ hours, 19 hours, etc. The worst case was one of a crew that worked an average of 21 hours daily for five consecutive days. It appeared, however, that these crews were all on short and irregular runs, and that they had to wait at branch termini for boats or were otherwise delayed. Asked if the men could reasonably endure these hours, witness said that they could not, unless they slept some during the time they were on duty. It is against the rules to sleep on duty. After a good deal of questioning, it appeared that witness would mildly censure the men for sleeping on duty, if he knew of it; but if an engineman slept while on the road, suspension would be the penalty. Asked why the company did not put on two crews, so as to divide these long periods of service, witness replied that the men preferred the long hours; if there were two crews, the earnings of each would be reduced so that they would be dissatisfied. In another case a pick-up crew worked regularly from about 2 a. m. to 4, 6 and 8 p. m., but there was opportunity nearly every day for the men to sleep some; and a good deal of the work was switching, not road work. Asked why this run was not changed, witness said that "everybody was after it"; the men make large wages on account of the extra hours for which they are paid each day.

Q. Are these long hours safe? A. On these runs they are. Q. Was it safe for Hildebrand to run as he did on December 28, 29 and 30? A. This was not excessive, considering that he had had a long rest on Thursday.

Asked about the schedules of night passenger trains at 60, 70 and 80 miles an hour from Silver Spring to University, where they have to run regularly under the double green signal, witness said that enginemen were always freely excused for not making time whenever caution signals necessitated slackening of speed. Q. Would it not be better for No. 66 to have a separate schedule for Sunday, when it makes extra stops? A. No, for this would make one more schedule on the time table and perhaps thereby confuse trainmen.

Answering Commissioner Clark, witness said that the double green was not only a signal indicating that a train might be expected at a cross-over, but also indicated caution throughout the block section (the same as a single green). Double green at Silver Spring at 6:28 for a regular passenger train would be wrong and the train should stop. Q. Why should the engineman of No. 66 say that he received double green at Silver Spring on December 30 if he actually received white? A. I cannot answer. Q. Has this engineman been disciplined? A. We have as yet received no conclusions in his case.

Thomas Fitzgerald.—I have been general manager of the Baltimore & Ohio two years. Before that was general superintendent and superintendent. The block system has been in use on this section of the line about 15 years. We have about 700 miles telegraph block and 100 miles automatic. There have been cases of enginemen disregarding both distant and home automatic signals, and in one case there was a collision from this cause. We have had false clear automatic signals, but not to any extent. Under the telegraph block system on our road this is the first accident of any consequence that I can recall. The telegraph block system, properly operated, is probably as safe as the automatic, but the automatic is a great relief to the railroad officer, because with it he can say that he has adopted the best protection known. Except for this point the telegraph block system is probably just as good.

Q. What is the weakest point of the telegraph block system? A. The human family. Q. Then the thing that needs attention in it is the personnel, is it not? A. Yes. Q. What inspection have you, to maintain the integrity of the block signal? A. We have the usual number of officers for looking after the men. We have not yet had any surprise checking. We have thought that we could get better service from the men by trusting them. Our men, as a rule, are a good set. Excessive checking may impair a man's individuality. Still, said the witness, we shall probably have to adopt surprise checking. Q. Have you had complaints of unreliability of signalmen? A. Yes, sometimes. A man, perhaps, becomes addicted to intoxicating liquors; a fellow operator or some other observer may report him. Q. Should it not be the duty of some one on the part of the road to keep a check on these men? A. I do not know how you could keep a constant check on all the operators. I find that an

efficient train dispatcher seldom has a bad operator. The minimum salary of block signal operators now is \$52, and for 12-hour men \$55. At interlocking towers the pay is from \$70 to \$75. Q. Will \$47 to \$60 a month furnish you with capable operators? A. The service is easy, and for competent men there is a good chance for advancement. Of natives, we keep all we educate, but the floaters make some trouble. I find that other roads are in the same situation. The trouble is that there is not a sufficient supply of operators. Q. Have you tested devices for automatically stopping trains? A. We test everything that has merit, and we are constantly looking for everything new that is good. The only device that I remember as being tested by us recently is one for shutting the throttle valve of the locomotive, which was tried by our signal department at or near Pittsburg some time since.

Asked as to the relative cost of the automatic and the telegraph block system, witness said that, taking everything into account—the interest on cost and expenses of operation—the automatic was but little cheaper than the manual. (In this comparison, however, the fact that the block sections under the automatic were much shorter than under the telegraph block system was not taken into account, apparently.) Q. Is the automatic superior in point of safety? A. I cannot say; that is a matter of opinion. Q. Are you going to extend the use of the automatic? A. We are. Q. Does any officer keep watch to see that trainmen do not work excessive hours? A. Some six months ago train dispatchers were instructed to check the trainmen and take them off if found to be working too long. Q. Is it safe to let engineers decide for themselves when they ought to take a rest? A. I am not sure that we should do otherwise than leave the men to judge this matter for themselves; though, of course, there will be exceptional cases of men who will deliberately stay out too long.

Asked about the agreement of the company with brotherhoods of employees, witness replied that there was one to the effect that after working 15 hours a man should be entitled to 10 hours' rest. Asked about engineers disregarding signals and the punishment therefor, witness could give no exact information. Men are censured and, at times, suspended. Q. Should not there be distant signals all along the line? A. Possibly it would be a good thing; but I do not recall an accident due to the lack of a distant signal. It is not unusual for trains to come in 30 minutes late on a foggy night and report that the delay was due to the necessity of slackening speed on account of fog. Very few of our engineers have passed stop signals. In case a man of 20 years' experience and a good record commits this error, it is a question whether it is to the interest of the company to dismiss him. Of course, we suspend him, perhaps 60 days. Witness could not recollect cases of signalmen giving false clear signals, or what punishment had been imposed, though he thought there had been several cases.

Concerning a daily record of the watches of all conductors and engineers, which is required by the rules, witness could not say that it had been regularly enforced, but in general he knew that conductors and engineers took pride in having their watches run accurately. Asked why the former five-minute allowance for variation of watches, in the case of trains of the same class meeting, had been abandoned, witness said it was because the American Railway Association had so changed the standard rules. It was found that trainmen would use the five minutes. Asked about the propriety of extinguishing the semaphore light at a block station which is closed for the night, witness said that this practice also was in accordance with the general standard practice.

Asked about the effect of the Maryland eight-hour law and about cases of signalmen working outside after the eight-hour period, witness said there had been a number of such cases. It was difficult, if not impossible, to regulate men's conduct when off duty. In one case an eight-hour signalman was found to be running a saloon. He was dismissed; then he married the saloonkeeper.

Asked concerning the discrepancy in the testimony of the different witnesses as to the times that engine 2120 passed the several stations, witness said that from the records made by the block signalmen at stations west of Silver Spring, and from the views of men familiar with the line as to what the speed of the train would be, one would readily conclude that the record of the signalman at Silver Spring was right. (This would indicate either that Hildebrand's watch was three minutes fast, or else that he misstated the time.)

Referring to criticisms of the clocks in the block signal stations, and at other places on the road, as being poor timekeepers and requiring to be set nearly every day by the standard time received over the telegraph wire, Mr. Fitzgerald, and also Miss Harrington, testified that every operator receiving train orders, comes by force of habit to keep his clock pretty nearly right, because in every order received the dispatcher gives the time, and the operator automatically glances at his own clock to see if the time given by the dispatcher corresponds with his own.

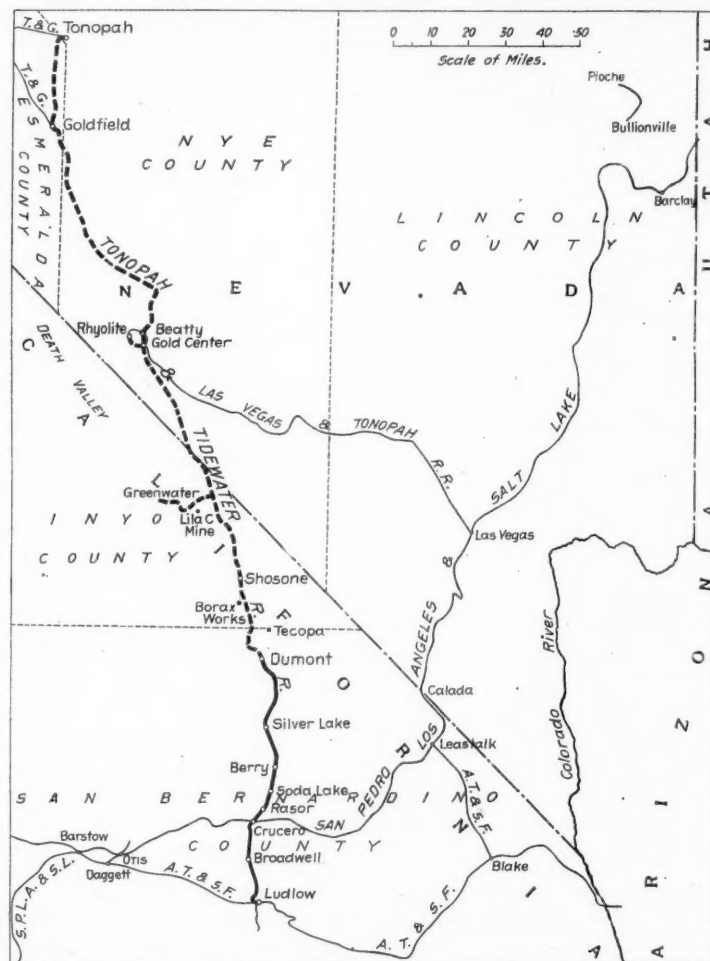
The coroner's jury which investigated the collision on the Baltimore & Ohio at Terra Cotta, D. C., December 30, held eight railroad officers and employees responsible for the disaster: William E. McCauley, assistant division operator; T. F. Dent, train dispatcher;

J. W. Kelly, Jr., division trainmaster; Harry H. Hildebrand, engineer of No. 2120; Frank F. Hoffmeier, conductor of No. 2120; R. L. Vermillion, engineer of train No. 66; George W. Nagle, conductor of train No. 66, and William Dutrow, operator at Silver Springs. The verdict charges Dutrow with the chief criminal responsibility, and the rest with a lesser degree of negligence. It directs that Dutrow be held for the action of the grand jury. The block system on the Baltimore & Ohio is declared not to afford satisfactory protection, and the rates of wages paid the operators and signal men are declared insufficient. It is also recommended that all block signal stations be kept open throughout the day [and night] and no additional duties given to the operators aside from working the signals and attending to the telegraph.

The Tonopah & Tidewater Railroad.

The projected route of the Tonopah & Tidewater Railroad and the line already built are shown on the accompanying map. The road is to extend from Ludlow, Cal., on the Atchison, Topeka & Santa Fe to Tonopah, Nev., 250 miles. It is already in operation from Ludlow to Dumont, 75 miles, and is being rushed to completion as fast as heavy rock work will permit. As soon as the grade is built through the Amargosa canyon, north of Dumont, track can be laid at the rate of a mile a day on the rest of the road.

After leaving Ludlow the road enters a highly mineralized re-



Tonopah & Tidewater.

gion in which are a number of old lake pits rich in borax. About 20 miles north of Dumont are extensive borax deposits which have been developed by F. M. Smith, who is the principal owner of the road. A borax plant will be started as soon as the track reaches this region this spring.

The company will soon put in service an automobile line from the main line about 10 miles east to Tecopa, which is the center of a group of rich mines, as a feeder to the main line. From a point about 120 miles north of Ludlow a branch will be built westward into the Greenwater district, whose copper and gold mines are now being rapidly developed. An automobile service will be established to the "Lila C" mine. There will be branches to Rhyolite and Bullfrog, while the main line will run north via Goldfield Center and Beatty. Bullfrog will be 168 miles from Ludlow by this road.

While the Greenwater district is a recently opened one, it is believed that its copper belt extending along the Tonopah & Tidewater will rival Butte as a copper producing region. Copper is in the main a recent discovery; the development of gold and silver mines in Tonopah, Goldfield, Bullfrog, Rhyolite and many smaller centers of western Nevada has been going on for several years.

Progress of Electrification in 1906.

The Western Society of Engineers, Chicago, held their annual meeting and dinner on January 8. The present membership of the society is 925, the increase for the past year being 96. The officers elected for the ensuing year are: President, W. M. Abbott; Vice-Presidents, Andrew Allen, E. N. Layfield and A. M. Talbot; Treasurer, Albert Reichman; Trustee for three years, Willard A. Smith. Mr. B. J. Arnold, the retiring President, delivered the principal address of the evening, his subject being "The Progress of Electricity on Steam Roads in 1906." The address was illustrated with lantern slides. Much of the ground covered by Mr. Arnold is already familiar to readers of the *Railroad Gazette*, dealing as it did, briefly, with the acquirement of paralleling electric roads by steam roads, and with the electrification of the New York Central terminal at New York City, the Pennsylvania Railroad tunnel work at New York and also the Hudson & Manhattan and the New York and Jersey Co.'s tunnels, the New York, New Haven & Hartford electrification work, the West Jersey & Seashore line of the Pennsylvania, and the Southern Pacific's plans for electrifying about 20 miles of its suburban steam lines at Oakland, Cal. He also said: "The equipment of the Cascade division of the Great Northern Railway, over the Cascade mountains, a distance of about 100 miles, although not yet definitely decided, is contemplated. Its equipment would eliminate the use of steam locomotives now operating over a tortuous piece of road, and through a long and difficult tunnel. Electrification is also contemplated upon a division of the Southern Pacific Railway, through the Sierra Nevada mountains, for the purpose of eliminating the difficulties due to tunnel operation, and of increasing the capacity of the road, which is now limited by the size of the present steam locomotives."

Regarding the St. Clair tunnel of the Grand Trunk, he said: "In order to eliminate the present objections regarding the use of steam locomotives in the St. Clair tunnel of the Grand Trunk Railway, lying between Port Huron, Mich., and Sarnia, Ont., the officials of that company decided a little over a year ago to adopt electrical propulsion. After due consideration it was decided to adopt the single-phase method. This system was adopted for several reasons, the principal one being the objection to the use of the third rail in the yard at each end of the tunnel, which was quite extensive, and in which much switching had to be done in making up trains before entering the tunnel. The equipment will consist of six electric locomotives, weighing 120 tons each, having a normal capacity of 1,500 h.p., capable of exerting a drawbar pull of 25,000 lbs. at a speed of 10 miles per hour, and a maximum speed for passenger train service of 35 miles per hour. The power station, which is now well under way, will contain two 1,250 k.w. turbo-generators, either one of which will be capable of operating the tunnel up to its full capacity, the other being held in reserve. The decision to adopt single-phase for this installation was made by the speaker some time prior to the decision of the New York, New Haven & Hartford Company, and, like it, the working of this system in this class of service will be carefully watched."

"The Erie Railroad has a commission organized for the purpose of electrically equipping its lines, now running out of Jersey City, a total of about 250 miles, although it is contemplated that but 35 miles will be immediately equipped, comprising the division extending from Jersey City to Greenwood Lake. In addition to its suburban lines in the vicinity of Jersey City and its terminal, the road now has under construction 34 miles of single track, known as the Rochester division. This division lies between Rochester and Avon, N. Y., with a branch between Avon and Mt. Morris. The single-phase alternating current system will be used, having a working pressure of 11,000 volts on the overhead conductor. The energy will be secured from Niagara Falls at a pressure of 60,000 volts. Six passenger coaches, 54 ft. long, and seating 56 people, will be placed in service, each car weighing about 50 tons and equipped with four 100-h.p. motors. These cars will be capable of a maximum speed of from 45 to 50 m.p.h. and of hauling one trailer. While this extension of the Erie is short, the company has under contemplation the electrical equipment of its entire suburban service surrounding Jersey City, which will involve an expenditure of some \$15,000,000. Plans are now being formulated for this expenditure."

"An important piece of equipment for electrical operation is now under construction by the West Shore Railroad between Utica and Syracuse, N. Y. The work in hand covers a distance of 44 miles, and the passenger schedule provides for limited trains in each direction, making the distance from terminal to terminal in 1 hour and 22 minutes."

"In deciding upon the plans, the relative merits of alternating current overhead equipment and third-rail direct-current equipment were carefully considered, and the decision to install the direct-current system was largely determined by the general flexibility of a third-rail equipment should it become desirable to make lateral extensions, install additions, side tracks, etc. Over certain sections of the line traffic conditions require that two additional tracks be built. These tracks will enable the passenger trains operated electrically at 55

and 45 miles an hour to avoid interference with freight trains operated by steam—fast freight trains with a schedule of about 25 miles an hour, and local freights with a schedule of about 15 miles an hour."

"Construction work was started on May 15, and is well under way at the present time. Electric power will be furnished by the Hudson River Electric Power Company, which will deliver three-phase, 60,000-volt current at the railway company's sub-station seven miles west of Utica. The Hudson River Company will for the present generate this current at its auxiliary steam plant in Utica, but upon the completion of its contemplated transmission lines current will very likely be taken from the hydro-electric plants owned by the company in the eastern part of the state. There will be four sub-stations located about 10½ miles apart. These will be identical in construction and each will be equipped with two 300-k.w. rotaries and the necessary apparatus for transforming 60,000-volt three-phase current to direct current for distribution to the rails at 600 volts."

"The transmission line towers will be of steel and similar in design to those built for the Syracuse Rapid Transit Railroad. There will be 391 of these towers, with normal spacing of 480 ft. Most of the towers are 39 ft. high, the highest being 63 ft. The line conductors will be located at the vertices of an equilateral triangle 7 ft. on a side."

"The third-rail construction is the Willgus under-running protected type, this being the standard adopted by the New York Central. The third rail is located between the parallel tracks except where curves, or other special conditions, require it to be transferred to other sides of the track. The company will operate 15 closed cars, 49 ft. over the bumpers, each equipped with four 75-h.p. motors per car, and multiple unit control."

"The Spokane & Inland is a single-phase line between Spokane, Wash., and neighboring cities, having a total of 114 miles. The capital invested in the project is, approximately, \$3,500,000. The service includes passenger, mail, express and carload freight. The power is purchased from the Washington Water Power Company and is delivered to the railway company, as three-phase, 60-cycle current, at a frequency changing station 10 miles south of Spokane. This station has four frequency changers, each of nominal 1,000 h.p. capacity, which convert the current to 25-cycle, 2,200-volt, single-phase current. For transmission to the sub-station this 2,200-volt current is stepped up to 45,000 volts and transmitted to 15 sub-stations, where it is stepped down to 6,600 volts for direct connection to the trolley circuits."

"The cars and locomotives operate on three different voltages at different parts of the line. In the country 6,600-volt alternating current is used and in the smaller towns 700-volt alternating current, while within the limits of Spokane 600-volt, direct current is used. In the country and through the small towns a pantograph under-running trolley is utilized, while in Spokane the ordinary under-running trolley wheel is used. The passage from the alternating current to the direct current system is done by operating a commutating switch, which makes all necessary connections, and by changing the trolley from the pantograph to the wheel type."

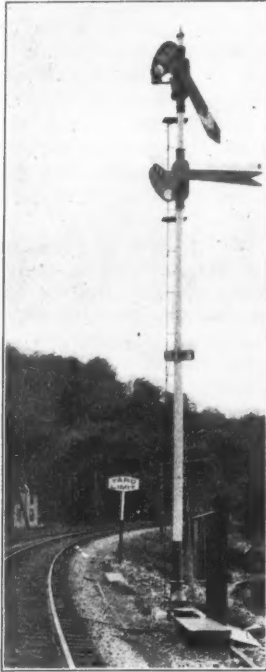
"The cars are equipped with four 100-h.p. alternating current motors. The locomotives use the same type of motors, but have a capacity of 150 h.p. each. Both the locomotives and coaches may be operated on the multiple unit system. The locomotives are capable of handling seven standard freight cars, fully loaded, at 30 m.p.h. on level track. A locomotive weighs 49 tons and has a length over the bumpers of 29 ft."

Referring to European work, he said: "Some recent installations may be of interest. Progress is being made on the tunnel work under the Seine for additional lines to the Paris Metropolitan Railway. The project for the tunnel under the English channel between Calais and Dover has acquired a new interest and is a subject under much discussion. The proposed tunnels would be 18 ft. in diameter, the submarine portion being 24 miles in length, with approaches six miles in length, and, of course, would be operated electrically. This tunnel is designed to carry the rolling stock of the principal European railroad companies. * * *

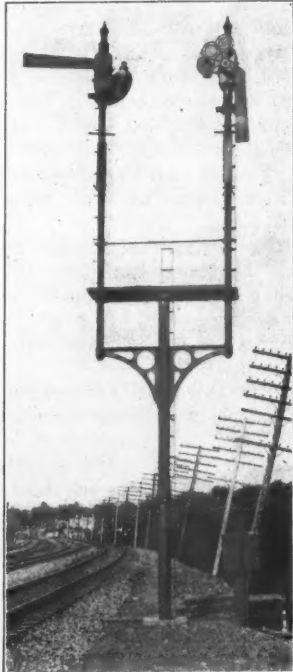
"From an examination of the map of the business district of Chicago, bounded by 16th street, Halsted, Chicago avenue and the lake, it will be seen that 23 per cent. of this area is occupied by the tracks of the steam railway companies. In view of the present state of the art of electric railroading the right to vitiate the air of our congested districts by the emission of large quantities of carbon dioxide from the stacks of the numerous locomotives is as questionable as the right to foul the air by the stench from our stock yards. As there is now a possibility of the removal of these yards from our midst, is it unreasonable to hope that all of the steam railroad companies, through the wise foresight of their officers, may help to purify and beautify the city by assisting the general movement now under way by our progressive, civic bodies for this purpose? In my judgment, at least one, and probably three, of the companies now operating in the city of Chicago can afford to and would profit by the electrical operation of their suburban trains."

Automatic Block Signals on the Baltimore & Ohio.

The Baltimore & Ohio has recently installed a number of the top mast direct-connected type of electric motor signals made by the General Electric Co. This signal, formerly known as the Herman signal, was illustrated and described in the *Railroad Gazette* July 1, 1904, but since it has been taken over by the



Independent Home and Distant Signals, New York Central.



Three-Position Signals on the B. & O.

General Electric Co. it has been redesigned and improved in many respects. The entire mechanism is contained in a metal box or case at the top of the post and the signal blade is attached direct to the main shaft without the interposition of rods or levers; the relays are mounted in a box at the base of the post for convenience in inspection and maintenance. The signals on the B. & O. are of the three-position type, the downward inclination of the arm indicating proceed.

The motor, while being of standard design, embodies some special features. The field coils are wound with a special flexible enamel covered wire which possesses high insulation resistance and withstands an abnormal puncture test. The pole pieces are built of a special grade of laminations. The armature coils are wound in slots in a laminated core, and after being baked at a high temperature are subjected to the vacuum insulating process, which thoroughly impregnates the armature with a compound of high insulating properties. The commutator is composed of copper bars of uniform hardness, mica insulated. Brush-holders and brushes are easy of access, the springs exerting a uniform pressure between the brushes and the commutator, and an easily removable commutator cover is provided.

The motor transmits movement to the signal clutch wheel by a train of gears. The clutch magnets, when energized, engage a toggle arm with bosses on the clutch wheel, transmitting the motion to the signal blade. The lock magnets, when energized, hold the signal blade in the desired position until these lock coils are de-energized, when the blade returns freely to stop position by gravity. The clutch and lock coils are wound with enamel-covered wire possessing the same characteristics as that used for the field winding of the motor. A dash-pot is provided for retarding the return motion of the blade to any desired degree. This dash-pot is filled with a special grade of Russian oil, the viscosity of which is not affected by temperature. The absence of reciprocating motion in operating the signal blade and the avoidance of vertical rods, guides and jaws and all outside connections to the spectacle casting, is a feature of considerable advantage, tending toward simplicity and reliability of operation.

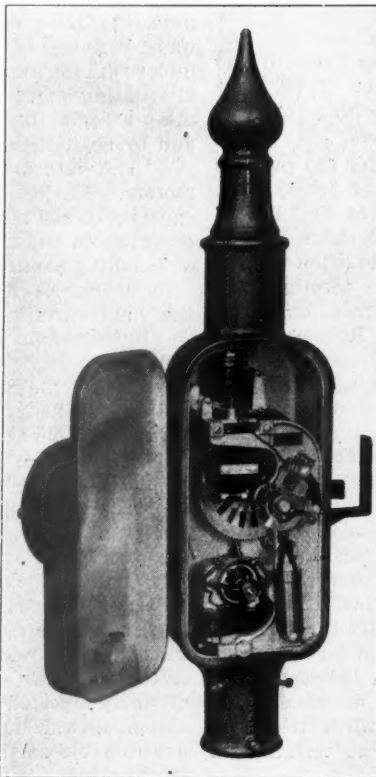
All parts of the signal mechanism are interchangeable. The toggle levers are composed of a non-corrosive nickel alloy and the gears and clutch wheel are of good cast-iron; the pinions are of steel. Bearings are of bronze and are provided with convenient means for lubrication. The contact fingers are firmly fixed on square insulated studs, and are non-adjustable. The contact sectors are firmly fastened to the main shaft, an extra adjustable circuit control being provided. The contact sectors and fingers are composed of a special non-corrosive alloy. The side frames are of high grade cast-iron, with solid webs. The entire mechanism, when assembled, is strong and rigid, susceptible of but little wear, and, apart from the brushes, requiring no adjustment. This non-adjustable feature of the mechanism makes it adapted for location at the top of the mast, as maintenance is reduced to a minimum, the only attention required being that for lubrication and inspection of the commutator and brushes. A seat is provided at the top of the post for the maintainer. While top mast signals have occasionally been objected to on the score of difficulty of maintenance, it has been found by practical experience in service on the Baltimore & Ohio that this signal is not open to this objection. The elevated location of the signal places the mechanism at the point where the work is to be done and the signal is above the influence of surface fogs and moisture. The motor is free from the action of frost, which has frequently caused trouble with signals of the ordinary type, where the mechanism is located at the bottom of the mast. The direct-connection of the mechanism to the signal shaft insures economy of current consumption and reliable operation at low voltage.

About 150 signals are in operation on the Baltimore & Ohio. Most of these are used as distant interlocking signals, but 25 have been installed for automatic service on the main line between Baltimore and Relay. These signals were put in operation in July, and during the months of August, September, October and November they have indicated 368,712 movements without a failure.

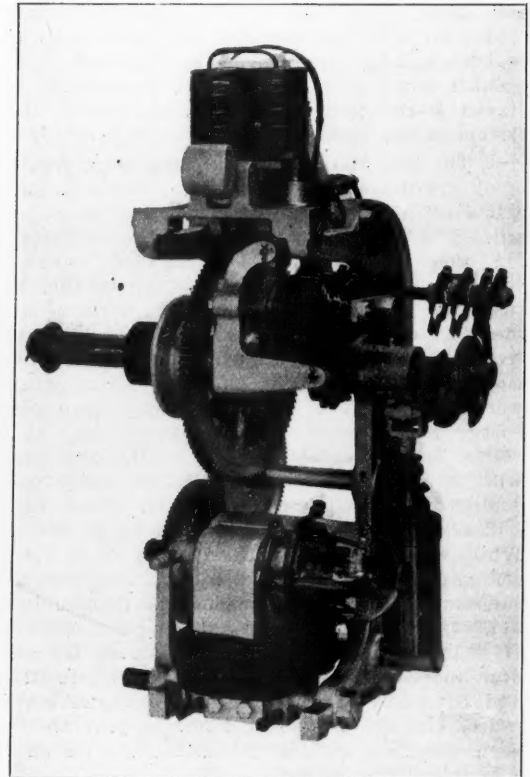
This signal is also adapted to two-position operation, and the design of the mechanism case is such that a signal may be inserted in the mast at any desired point, thus two or more signals, with independent mechanisms, may be operated on the same signal mast. This arrangement is shown in one of the illustrations of an electric top mast home and distant motor signal with independent mechanism on the New York Central.

Washington Correspondence.

WASHINGTON, Jan. 15.—The hearings in progress before the House Committee on Interstate and Foreign Commerce on the Sherman bill proposing to require all railroads engaged in interstate



Top Mast Signal Mechanism in Case.



Signal Mechanism Removed.

passenger traffic to issue interchangeable mileage books at the rate of two cents a mile, and several other bills proposing two-cent fares in various forms have attracted comparatively little attention. Although the Sherman bill was introduced at the instance of organizations of commercial travelers, and although they were notified that the hearings would take place and were requested to send

representatives no one has yet appeared in favor of the bills. Representatives of several important railroad systems have submitted arguments in opposition. They have contended that either one of these bills would have the effect of reducing all interstate rates and most state rates to a maximum of two cents per mile. The unreasonableness of a proposition to enforce such rates on many of the roads of the country has been pointed out and it has been argued that the reasonableness of a passenger rate depends very largely upon the density of traffic on the line of a road and the cost of conducting its passenger service. Representatives of some of the western and southern roads introduced statistics of population and of passenger movement to show that a rate that might be reasonable on an eastern road running through a densely populated part of the country, having a heavy suburban passenger business and well-filled through trains, would be ruinous to a road in the west or south serving sparsely settled communities and hauling passenger trains with very few passengers. It is contended that any of the bills would be unconstitutional on the ground that the rate prescribed would amount to taking the property of many of the roads without due process of law, and that it is beyond the power of Congress to enact a law like that proposed by the Sherman bill which would compel each road in the country to enter into contractual relations with every other road, to honor its tickets, and to become responsible for their redemption without regard to the responsibility of the issuing road. The hearings have not yet been concluded, but the questions and comments of members of the Committee seem to indicate that there is little prospect of favorable action on any bill that has thus far been presented.

J. C. W.

Railway Signal Association.

The January meeting of this Association was noticed, with a list of the new committees, in the *Railroad Gazette* of January 11, page 58. The first discussion was on how to remedy the effects of foreign current on automatic block signals. The committee report on this subject was presented at the October meeting, but not discussed. The principal recommendations of the committee were printed in the *Railroad Gazette*, October 19, page 333. The Secretary read a letter from Mr. Henry Bezer describing an arrangement of track relays which he had lately put in use on the Central of New Jersey at Bethlehem, Pa., to make automatic block signals proof against disturbances from foreign currents.

The paper described that with rails intact the foreign current via the track relay would be limited, but with broken bond wires, or a rail broken, the current would be considerable, increasing the nearer the exit end of the block was to the broken rail.

Protection is given by low wound auxiliary coils in the track relay, which must complete a circuit before coils of higher resistance can complete the signal circuit. The auxiliary coils are then out of circuit.

A shiftable weight adjustment renders the auxiliary coils inoperative at anything below a predetermined current. They could safely be adjusted to be inoperative at any current less than the maximum foreign current ascertained by artificially setting up with equivalent of a rail broken at the exit end of the block being measured, abnormal traffic conditions ahead, which should be a steel car train bridging the insulated joints dividing one section from the other, for a distance of four miles. Then track battery with a pressure one-eighth of the foreign pressure would operate the system in the worst weather, but any higher current could be determined upon, with a corresponding increase in track battery and weight in the armature for the auxiliary coils.

A relay between the track battery and the rails interposes resistance of only one-fourth of an ohm when the track relay has to be operated, but with a train in the block this resistance is increased to 5 ohms. There is therefore practically the same track battery output whether there is a train in the block or not.

Potash batteries can be used. Polarization is prevented because there is no long-continued overdrift. Their life can be accurately calculated. Storage batteries can also be used.

Mr. Bezer's arrangement has been in use about three weeks and no satisfactory report of the results in service can yet be made. The large amount of battery power needed makes the expense of this arrangement much heavier than for the ordinary simple track circuit. The letter was referred to the committee.

In the discussion the first speaker was Mr. Waldron. The recommendation of the committee that State Legislatures should be asked to pass laws protecting steam railroads against electric lines was injudicious, he declared. The electric railroad has a right to exist, and there is no use in trying to secure the passage of one-sided laws.

On the Philadelphia & Reading the most prominent characteristic of foreign currents felt in the signal instrument is the variability. Changes in the loads on the electric lines make wide variations in the disturbances at different hours of the day. These currents have, at times, been strong enough to burn out track relays. On 45 blocks the Reading has at the battery end a one-tenth ohm

relay, connected in series with the battery. The signal battery is at that end and the signal circuit goes through the back point of the low resistance relay. This arrangement has worked pretty well so far, though in wet weather the low resistance relay sometimes picks up and stops a train.

On the Union Pacific some track circuits, at an electric interlocking, were demoralized by a 15-ampere current, and alternating current track circuits were installed for the whole plant. On the third-rail line of the West Jersey & Seashore, where alternating currents are used for the track circuits for 35 miles of line, there were in the first month only two failures due to anything wrong in the track circuit.

The meeting next took up the report of the committee on interlocking of block signals, which was the subject of the chief discussion at Washington last autumn. It was in this report that the new and comprehensive scheme of signaling was proposed, including upward inclination of arms and two lights at every signal.

The Secretary read a letter from Mr. I. S. Rayner protesting against the use of a red light (as recommended by the committee) as "the common property of three signals." Rather than have so many red lights, to be treated as signals, the writer would have a light to be of the nature of a marker and nothing else.

A letter was also read from Mr. Buckelew, Superintendent of the Central Division of the Philadelphia, Baltimore & Washington, where are located the signals, giving indications by upward inclinations, described in the *Railroad Gazette* of October 19 last. Mr. Buckelew says that the enginemen and firemen, after running under these signals for three months, like them better than the standard signals, under which they run on the Philadelphia terminal division. They commend specifically the three novelties—namely, putting the arm "up in the air," using a single blade in three positions, and staggering the lights at night. The great beauty of the scheme is found in its relief to the engineman. He is required to remember nothing. Under this scheme an engineman could run anywhere with no special instruction. The two-light feature is especially valuable where there are many confusing lights, and the cost of the dummy light is well repaid.

It is proposed to use upwardly inclined signals at the new union passenger terminal of the P., B. & W. and the B. & O. at Washington, and a proposal is being considered to arrange the lower or smallest blade (see *Railroad Gazette*, October 26, 1906, page 369, diagram No. 2, signal No. 6) so as to give indications by it for all routes when necessary or desirable. At a facing point this signal is primarily designed to indicate only for the diverging route (as a crossover), and unless such route leads to another clear signal the arm would be set at 45 degrees. But this same indication is at times desirable for a movement along the main line, as for example, in case a train is stopped some distance beyond the signal, and it is desired to have a switching engine attach a car to the rear of the standing train.

At this point there was a lengthy discussion as to whether it is necessary thus to provide fixed signals to give all the indications which may be necessary in switching. Finally it was moved by Mr. Sperry (General Railway Signal Company) that "track layouts and signals should be so arranged as to provide fixed signals for all necessary movements," and this resolution was adopted. In this connection it should be observed that decisions made at a January meeting of the Association have only the effect of declaring the sense of the meeting; all decisions which affect anything of the nature of standard practice must be approved by an annual meeting before they can be regarded as the authoritative declarations of the Association.

There was general agreement with the rule, formulated by Mr. Ames and printed in the code of the Lake Shore & Michigan Southern, that where a signal is out of order hand motions may be used for switching movements, but movements from station to station should be made only on authority of a written card; but no vote was taken. After a brief discussion the following recommendations of the committee were unanimously rejected:

(e) That the stop indication shall be given by red lights in a vertical line.

(f) That the stop and proceed indication shall be given by red lights in an oblique line.

(g) That lights in a horizontal line shall be used for information signals.

The paragraph describing the arrangement of arms (three on a post) was left for future discussion. The use of a purple light for stop in dwarf signals was approved, as also that providing that a stop signal in the 45-degree position should be used to give a distant indication that the next signal would be found at stop; but the use of two arms on interlocking distant signals was not approved.

The discussion on circuits for interlocked signals was marked chiefly by a strong protest, voiced by Mr. Cade and supported by others, against the excessive use of costly electric locking to provide against dangers which, if the discipline of the signalman and the engineman is good, are not dangers at all, or at least are so greatly reduced that the wise railroad manager had better use his available money for the promotion of safety on his railroad in other direc-

tions, or on other parts of his lines. It was set forth with great vigor that we have been using more and more elaborate appliances year by year, and yet have not secured an arrangement which is satisfactory to the majority.

The report of the committee on standard specifications for all-electric interlocking was taken up and a few of the paragraphs discussed, beginning at the point where the discussion was broken off at the October meeting, but the members soon came to the sensible conclusion that details of this kind had better be perfected in committee.

Panama: The Railroad and the Canal.

BY FULLERTON L. WALDO.

From December 28 to January 2 the writer visited the Isthmus with a party of Congressmen who were investigating the canal work. In the five and a half days at our disposal we crossed the Isthmus four times on a special train which stopped at various points to allow of detailed investigation of specific engineering problems. We devoted half a day each to Culebra, Gatun, Cristobal, La Boca, and the Ancon Hospital; we also visited Gorgona, Bas Obispo and the cities of Colon and Panama (old and new), making our headquarters at the Tivoli Hotel on Ancon Hill in the canal zone, just outside the city limits of Panama. During our visit it did not rain, with the exception of one or two brief showers, the temperature in the daytime averaging 86 deg. The 24-hour average temperature in January (the nights being comparatively cool) is 74 deg., while the temperature of the hottest month, July, is 76 deg. January is considered the most agreeable month of the year. A curious fact about the rainfall is its rapid decrease in quantity as one goes

western states, the Northern Pacific having purchased a million in the past year. The short-length French rails (19 to 24 ft.) have been replaced by the 33-ft. 70-lb. American rail, the track being 5-ft. gage. Wood-burning engines are no longer used. The locomotives generally employed are from the American Locomotive Company, but 40 new Baldwins are about to be put in service. The commission requires, for all purposes, about 685 tons of coal per day, which all has to be brought from the States.

All through freight is handled at night. The trains bearing spoil from the Culebra cut and the special trains have made it necessary to cut down the passenger traffic from four trains per day each way to three, each consisting of ten heavily loaded cars. The negroes from Jamaica and Barbados, Trinidad and Martinique have developed a passion for short-haul visiting from station to station whenever they get the chance. The first class fare across the Isthmus has been recently reduced to \$2.40, or five cents a mile; the second class fare (usually taken advantage of by the negroes) is \$1.20. The employees of the road travel for half fare, but it is safe to assume that nine-tenths of the white men of the canal working force have passes. The old terminal at Colon, so far as freight traffic is concerned, has been abandoned in favor of the new site at Pier 11, Cristobal, in the suburbs of Colon. The roundhouses, turntables and machine shops have been removed to this point, but the docks of the Panama Railroad and the Royal Mail steamships remain at the original location. There has been no congestion of freight at the canal termini since the middle of December, 1905. We saw the ships being expeditiously unloaded by the stevedores at Colon, and noted that at La Boca (the Pacific terminus) four Wellman-Seaver electric cranes (capacity 3,500 lbs. each) are employed to facilitate unloading. The crying need at



Culebra Cut. French Level (Top of Bank) and American Level.

southward across the zone. At Colon the rainfall is about 160 inches annually, at Panama 75 inches, and at the Island of Taboga, in the Gulf of Panama (selected as the site of the I. C. C. Sanitarium) the rainfall is only 30 inches. The writer saw but one mosquito and heard two others while on the zone. The Tivoli Hotel, where we stayed, which opened for general business on January 1, 1907, is a large, substantial building (315 x 170 ft.), of Oregon fir and Georgia pine, with accommodations for several hundred guests and all the appointments of a first class seaside hotel in the United States: mission furniture, electric lights, shower-baths in tiled bathrooms, a telephone in every room, and screened doorways opening on ample verandas. The hotel was built by the Isthmian Canal Commission as the last (and the best) link in the chain of hotels that begins with the inferior Washington Hotel by the water's edge at Colon.

The railroad between Colon and Panama at present is what railroad men would call "a red-hot track." As the writer rode in the cab of the locomotive of our special, he was impressed by the amount of traffic held up on the sidings to let us pass. It is as busy a 47-mile length of single track as I ever saw. According to the annual report of the commission (issued December 20, 1906) 20 of the 35 miles of additional track planned for have been completed, and three-fourths of the work has been done for the remaining 15 miles. There is still, however, a great deal of track-laying to be done to join together the double-track portions. The cypress ties brought from the States are lying along the embankment in readiness. Many of the old lignum vitæ ties, which wear out but do not rot, have been in use almost ever since the road was opened for traffic half a century ago. I saw a great many carloads of new ribbed tie plates of the Glendon and Wolhaupter types which are being put in to supplant the old service plates. These new plates are the types used extensively in our north-

the Colon terminus is for breakwaters, to create a safe and commodious harbor. The "Panama" (5,700 tons), which left New York four days ahead of our boat, was unable to dock any earlier, having lost her four days' advantage by having to stand out to sea in a "norther" which beset the shipping in the harbor just before our arrival. No boat can remain at the wharves during these storms, which fortunately occur not more than once or twice a year. The Pacific terminus (La Boca) is almost invariably as placid as a mill-pond. There were six large steam vessels in the Colon roadstead as we came in, and six more unloading at the wharves, all of which had suffered more or less delay in consequence of the storm.

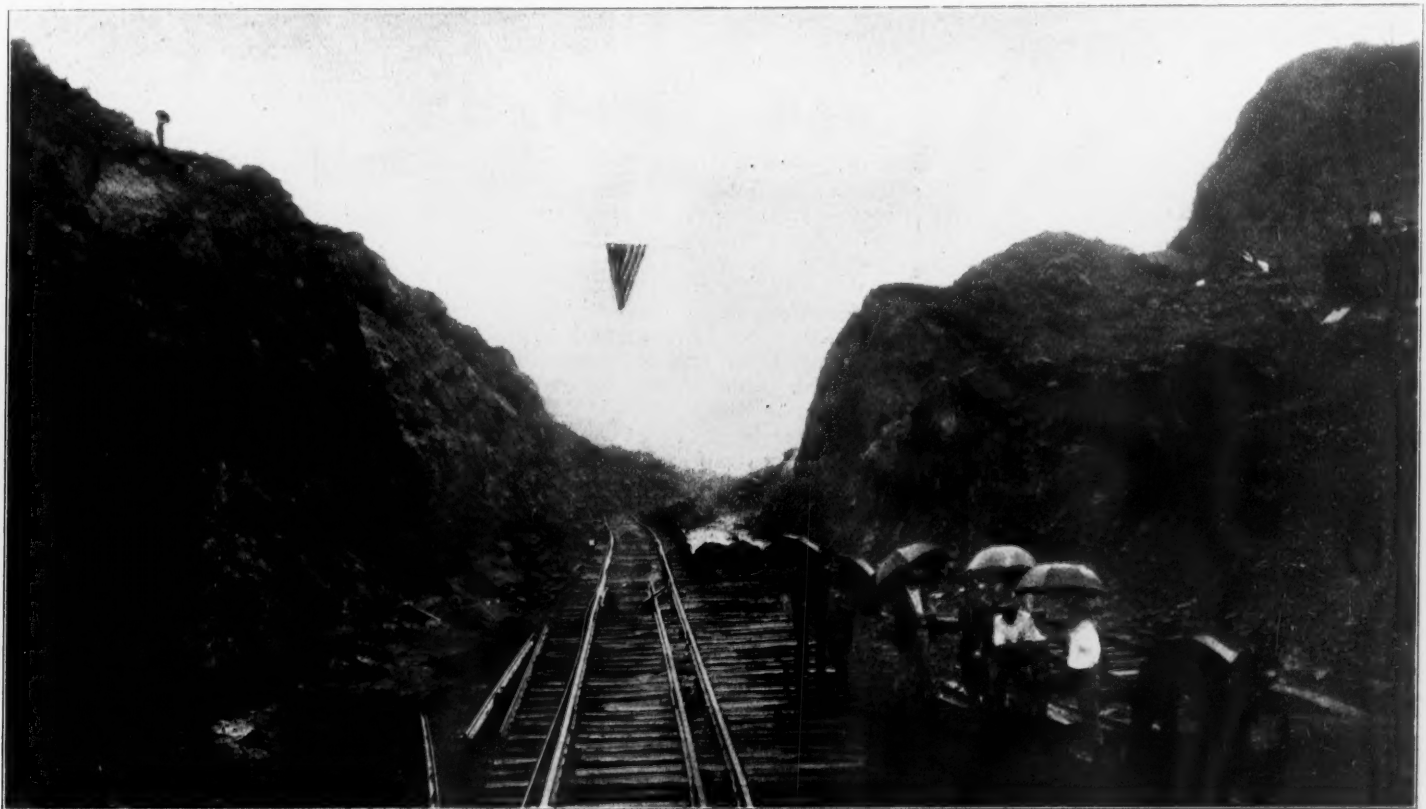
We went up the Atlantic end of the French canal a mile or so in a tug to Pier 11, just beyond the new and attractive Cristobal buildings of the commission on the point where the de Lesseps houses stand. This pier has been extended 400 ft. since April and roofed (with corrugated iron), and it is here that the reception to Mr. Roosevelt was held when he made his memorable speech to the canal builders. We saw a bakery, started up the day before our visit, turning out splendid bread at the rate of 24,000 5-cent, 1-lb. loaves per 10-hour day. A laundry (capacity 10,000 pieces a week) is being built to furnish a little healthy competition for the Panaman washerwomen with their Klondike tariff of \$3 per dozen pieces. A cold storage plant, in part designed by visiting experts from the Swift and Armour companies, is also building. Not half enough ice is made at present to supply the needs of the zone, though the railroad owns two plants at Colon, and the only conspicuous factory chimney in Panama is that of another plant, likewise railroad property; and there are several private plants.

The car shops at Cristobal accommodate 110 cars. The entire terminal had to be filled in to 4 ft. above sea level, where there formerly existed a morass chockfull of old French derelict machinery. There is a machine shop, with up-to-date equipment from

the Niles-Bement-Pond works. The one thing lacking to bring the plant fully abreast of the most modern practice is the electric installation which will come with the provision of water power. The equipment would be worth fully \$85,000 in the States, and cost \$91,000 here. In connection with the purchase of machine tools and steam shovels, at the prices which were named to me, I could not see where any "graft" came in beyond the manufacturer's reasonable profit. It is felt by the engineers generally that so much of the old French stuff has been found available or convertible that (when the vast amount of digging they did is reckoned in) \$40,000,000 was a bargain price for the canal and accessories. A visit to the Culebra cut and other canal excavations, and my observation of the conversion of old French iron by drop-forging and other processes, convinced me that we got the value of our money. No one, who has not been on the spot, can realize the extent of our indebtedness to the French—an indebtedness which the men on the Isthmus are the first to recognize. Of course the French excavators appear small beside our Bucyrus 70 and 95-ton shovels, and the Belgian locomotives cannot measure up to our 72-ton engines; the French dump cars look like children's express wagons alongside our western dump cars and vestibuled flat cars with their Lidgerwood drum and cable plow unloaders. But the French in their day did splendid work with the best excavating machinery then available, and it behooves us generously to recognize the dimensions of their achievement.

An 80-ft. roadway is being built across the shallow swamp-land, parallel to the railroad track, between Colon and the Monkey Hill Cemetery, to relieve the congestion in the yards. Of course the local population make much of every funeral, and the funeral trains have in times past seriously interfered with the regular work of the train despatcher's office. The cemetery, with its green grass and flowers, seemed to justify its rechristening as Mount Hope. We went through the immense storehouses opposite. The office work is facilitated by a thorough-going card-catalogue system, which accounts for all supplies handled. Three sections of one of the two buildings (dimensions over all, 580 x 160 ft., with 200-ft. exterior platform), are devoted to French hand-tools and hardware. Among the new material are roofing tiles, lead and wrought-iron pipe, fence wire, hotel supplies and household furniture. In the yards are piled perhaps 100 carloads of old French bar-iron of excellent quality.

An interesting bit of new construction is the 10-in. pipe line which has been laid across the Isthmus, alongside the railroad track, by the Union Oil Company of California, to convey crude oil from ship to ship, and to supply the railroad and the commission with any desired amount. A license fee of \$500 per month is paid by the oil company to the zone government, and it is stipulated that the commission and the railroad company may purchase the crude oil for 90c. per barrel. At the time of our visit the pipe had just been tested by flushing it with sea water, pre-



Awaiting the Presidential Train.

Mr. Bierd, the General Manager of the Panama Railroad, to whom our party was indebted for numerous courtesies, showed us his new track-throwing device, the essential feature of which is a swinging boom, mounted on a flat car, hauled over by a side-arm, which can throw 200 ft. of track 3 ft. 4 in. in 29 minutes with 17 operations. We noted in the Cristobal yards a 75-ton Bucyrus wrecking crane, and a Great Northern (Hill type) coal dock (20 per cent. incline up to pockets). We saw a Brown Hoisting Company coal unloader at work on her fourth vessel, near an old French drydock slip which is being widened to 310 ft.

Just beyond the yards, at Mount Hope, are the general stores of the commission. Across the track from the storehouses is the famous Monkey Hill cemetery, and at this point the toy railroad starts for the Mount Hope reservoir, two miles distant, a panoramic view of which is appended to the President's special report. This reservoir is a mile long and half a mile wide, and contains 520,000,000 gallons. The water elevation is about 55 ft. above high tide at Colon. From the reservoir a 20-in. cast-iron pipe line, connected with a 500,000-gal. steel standpipe, carries water to the city of Colon. The statement that salt water has been pumped through the mains to Colon is branded by Chief Engineer Stevens as untrue. The other great reservoir, made by damming the Rio Grande river, which supplies the city of Panama, furnished during the last dry season 56,000,000 gallons of water for the city and environs, without materially reducing its resources. There is no likelihood of a water famine ever again occurring upon the Isthmus.

sumably the first occasion on which the waters of the Atlantic and Pacific have come in contact at the Isthmus!

At Gatun the 7,900-ft. dam, 3,100 ft. through at base, from upper to lower toe, will completely obliterate the little native village that now stands at the confluence of the Chagres river and the old French canal at this point, 27 ft. deep. This dam is one of the features of the .85-ft. lock-level plan that will necessitate the relocation of a large portion of the railroad; nevertheless, so heavy is the traffic, it is intended to proceed with the double-tracking, pending these changes. Up to Gatun, which is about $5\frac{1}{4}$ miles from the Atlantic terminus of the canal at Colon, the French canal will prove useful for construction purposes in building the big dam. Two French dredges are constantly busy at the Colon entrance, and three at La Boca (Panama). No American dredges are as yet in use on the Isthmus. It is possible to ascend the canal at the Atlantic and for a mile and a half in a tug, and for nine miles further in a launch, except when the Chagres is in flood. Cayucas (native dug-outs) can go half way across the Isthmus when the water of the Chagres is high, and even around the bend and up to Alhajuela, some 15 miles above the Gamboa dam site of the sea-level plan.

At Gatun the "lay of the land" is plainly apparent from a point of observation on the hill above the railroad station. The dam, with a single angle, crosses the valley to a point of equal elevation on the hills opposite. A clearing of perhaps 200 acres has been made on the valley floor. As is generally known, the

dam is to be built chiefly of earth, with some of the local deposit of indurated clay, and it has been a mooted question with certain engineering critics whether an earth dam of the contemplated dimensions, containing some 22,000,000 cu. yds., will stand. The commission calls attention to the fact that the San Leandro dam in California is only 15 ft. lower than the contemplated height of the crest of the Gamboa dam, which is 135 ft. above mean Colon sea-level, and the San Leandro dam is also an earth dam, built by hydraulic methods, and other dams of similar type exist which may be cited as precedents. There will be no deep excavation in the hope of getting a firmer foundation than that afforded by the natural valley bottom of impervious soil. The delay in beginning the excavation for the locks at Gatun is due to the thoroughness with which borings have been taken over the entire site. Every 200 ft. square these borings have been made, some 500 in all, 200 of which are on the actual lock site. One of the critics of the stability of the dam has stated that but four borings were made. The locomotives used for hauling in the soft earth at Gatun weigh 72 tons—as heavy as it is practicable to use. Two 70-ton Bucyrus shovels with 3-yd. buckets have now begun excavating for the locks. It will be a year or a year and a half before the masonry work of reinforced concrete is started.

At Frijoles, three weeks before our visit, traffic was interrupted for two days by a rainstorm which flooded the track here and at Matachin to a depth of 4, 6 and 8 ft. Operations in the Culebra cut had to be suspended during an entire week. Yet on the 10th of December, when the flood had abated sufficiently to permit of a resumption of work, the yardage record for daily output was broken, which illustrates the recuperative power of the present engineering plant. There were no serious landslides in the cut, and the roadbed was practically uninjured. Whenever in the wet season there is danger of a landslide, shovels are sent in on the higher levels of the cut to dig preventive benches.

The iron bridge across the Chagres at Barbacoas has six iron spans of perhaps 80-ft. with a slight bowstring girder arch, these spans being supported on five stone pillars. At the time the bridge was built, some 20 years ago, it was necessary to assemble the parts on the spot by hand riveting, and it was perhaps the largest iron bridge of its type in the world. The destructive potentialities of the Chagres may be studied to advantage from this point.

We went through the machine shops at Gorgona and found a force of 800 men at work with pneumatic riveters, planers, steam hammers, lathes and cold-saws, converting old French material into usable implements, putting a dozen Lidgerwood unloaders into commission, rebuilding the little Belgian locomotives used by the French and repairing American locomotives. About 25 ft. of filling in the Chagres bed had to be done at this point to secure a foundation, and about 75,000 cu. yds. were excavated by steam shovel. A cupola foundry 70 x 120 ft. has been built, fully equipped with a steel concrete double-core oven, and a six-oven brass furnace,

deemed necessary by the head of the division employing such laborers.

All contract unskilled alien laborers who desire to do so, will be worked regular 10 hours' straight time. Those who do not so desire will be worked eight hours, as heretofore.

This order will take the place of or modify any and all orders heretofore issued bearing upon the length of the established working day.

—Chief Engineer.

It struck me that the machine shops at Gorgona were a first rate place for American skilled labor. The site is healthful, the shops are free from grime and smoke owing to the tropical open-



Building Sewers at Colon.

air order of architecture. The sanitary arrangements are admirable. There is a wash-room with 210 basins, where every man at the noon whistle finds hot water ready for him. The sanitary closets are automatically flushed every 30 minutes, and, as everywhere on the Isthmus, separate provision is made for white and colored employees. While we were on the Isthmus the decision was reached not to employ the Chinese, regarding whom there has been so much discussion in labor circles in the United States. It would be well if American organized labor should send delegates to Panama to study the peculiar conditions. I do not see how Mongolian labor would in the least conflict with the kind of work the white men from the States would qualify for. The white labor would do none

of the pick-and-shovel, navy work that the Canton coolie does. The white man's burden in this instance would be in the machine shops or other places where specialized labor is wanted and paid its wages. The best paid mechanics are the men on the steam shovels—\$210 per month for the shovel engineer and \$185 for the craneman. They earn their money, as was clearly demonstrated to us at Bas Obispo.

At Bas Obispo, where the Culebra cut begins, extending through the heart of the divide at Gold Hill to Pedro Miguel, we saw the 95-ton Bucyrus shovels Nos. 227 and 229 handling the hard basaltic rock after it had been thoroughly "shot" by dynamite blasts. There are some 28 steam shovels at work from end to end of the Culebra cut, varying from 50-ton shovels employed in grading work to the 95-ton giants which grapple with the heavy, close-textured rock. Each shovel has from two to five dirt trains serving it, and the rapidity with which the shovel can work is, of

course, conditioned upon the service of the dirt trains and the length of the haul to the dumps. A mistake made by the French was to dump their spoil too close to the point of excavation, which on the new plan necessitates considerable rehandling. I saw a western car loaded, under pressure, in a minute and a quarter—seven three-yard bucketfuls—but the average time for filling a dirt train of 10 cars is 30 minutes. The Lidgerwood unloaders, with drum and cable, plowing from end to end of the flat car trains (vestibuled by extensions) have greatly facilitated the work. The chief offices of the commission in the field are at Culebra. Through Mr. Stevens' office in the dry season a strong trade wind blows that necessitates weights on all the papers. By February 1 the last of the smaller French dwelling houses at this point will have been removed.

At La Boca, the Pacific terminus of the canal, several large ships were constantly unloading by means of four electric cranes



The Canal at Bas Obispo, October, 1906.

the charging floor of the foundry being reached by an air lift of five tons capacity. There is a core room, a casting cleaning room and a flask room, and the usual tool room for ensuring standard sizes. The present capacity of the foundry is 250 tons gray iron per month. A planing mill 60 x 120 ft. has been erected and a boiler shop 60 x 180 ft. Boiler makers, by the way, are in great demand on the Isthmus, just as there is a premium on the services of experienced railroad men of every type. The first class men in the foundry, whatever the particular nature of their occupation, get 75c. per hour, gold. As bearing on the length of the working day the following proclamation which I saw posted at Gatun is of interest:

Circular No. 84.

Culebra, Oct. 16, 1906.

Beginning Monday, Oct. 22, 1906, non-contract unskilled alien labor will be worked on a daily 10-hour basis on any work wherever

of 3,500 lbs. individual capacity. Many French lighters (clapets) and dredges lay half submerged, choking the confluence of the Rio Grande and the French canal excavation. The tide here has a maximum rise of 20.24 ft., with an average of 17. The Pacific entrance will require constant dredging up to the point where the lock-flight of two locks in duplicate begins, lifting the ships 55 ft. above the mean tide level to the lake surface. The creosoted piles of the immense La Boca wharves will not survive the ravages of the *teredo* more than three years. The teredo worm, with its hard shell and augur-bit head, growing sometimes to a length of 18 in., is as much of a 'longshore nuisance as the red ant is upon the land. It was thought that these yellow pine piles, with some cypress ones, would last a dozen years after the application of the creosote. Unprotected, the timber would hold out perhaps two years. But for the clamoring insistence on haste in beginning canal construction, the wharf foundations would have been built of iron or concrete so as not to require early renewal.

In the city of Panama many surprises, pleasant and unpleasant, await the visiting American. An unpleasant feature is the enormous quantity of bad liquor retailed at almost every store. The streets, with their abutting balconies, are squalid and dirty and narrow. But the city, thanks to the paternalism of the United States government, received in good part by the infant Republic, is now the best paved and sewered municipality in Central America or in the northern half of South America. Vitrified brick from Dubuque, Iowa, has been laid in cement on all the principal thoroughfares. Some of the side streets, as at Colon, are covered with crushed rock. A fine macadamized driveway has been built for six miles into the country—the most pretentious bit of road-building on the Isthmus. The price of real estate at Colon and Panama is appreciating; and a bright day dawns for the little Republic.

At the time of Secretary Taft's visit he disbanded the army and sold the navy, consisting of one or two small boats; a stroke of diplomacy which has proved a natural blessing. The President's visit did a great deal to reassure the faint-hearted and stimulate the laggards, and from one end of the zone to the other I heard nothing but enthusiastic expressions of recognition of the value of his visit, in giving the canal builders to feel that their work is understood and appreciated at home, and has the cordial sympathy of the Chief Executive. It made every man on the Isthmus proud to be able to show his Panama brethren what a splendid American we have chosen to be our President. The native population seem to feel that an almost God-like being came and sojourned among them for a little while and departed. It is good to see, too, on the Isthmus that the inestimable value of the services of Dr. Gorgas is generally recognized, and that this quiet, unassuming Christian gentleman is receiving in his lifetime his due meed of thanks and praise for the extirpation of the agencies of dreaded diseases.

It speaks much for his unfailing tact and courtesy that he has been able to invade thousands of native homes with fumigants and disinfectants without once giving cause of offense to a proud and sensitive people. Finally, in John F. Stevens the engineer corps of the Isthmus have a dean qualified for his command by years of experience; a man whom other men instinctively trust and obey; a man with no personal idiosyncrasies to stand in the way of getting the big ditch dug.

The Baden State Railroads in connection with the training of mechanical engineers for the higher duties of the railroad service have made regulations for admitting to practice as enginemen on locomotives such persons as do not purpose to serve permanently as such. These must be young men who aim to become mechanical engineers, but after their service and passing the examination required of enginemen they do not acquire right to appointment as such. The privilege of service on locomotives is granted only to those who aim to positions as mechanical engineers or as inspectors in railroad shops; and also to students in the Karlsruhe Technical School; all after having reached a certain grade in the preliminary studies and examinations, the men of the Technical School in their fourth year of the mechanical engineering course. The first two classes have the precedence over the school students. The period of service is three months for one class, six months for candidates as shop inspectors, and from four to eight weeks for students; and these latter only on locomotives served by a regular engineman and fireman.

The Conduct of Business on the Pennsylvania.

The following compilation shows graphically some of the details of the freight traffic on the Pennsylvania Railroad in 1905 and 1906.

Pennsylvania Railroad Statistics.

Total freight cars in U. S., Jan. 1, 1905.....	1,691,427
Total freight cars in U. S., Jan. 1, 1906.....	1,757,105
Total freight cars on Pennsylvania:	
Lines East and West, Jan. 1, 1905.....	208,274
Lines East and West, Jan. 1, 1906.....	216,999
Increase in U. S. in 1 year(12½ per cent.)	65,678
Increase on Pennsylvania(13.2 per cent.)	8,725
Increase in cars on Pennsylvania since Jan. 1, 1906..	17,647
Ordered by Penn. R.R. for 1907 delivery.....	17,415
Freight ton-miles on Penn. R. R., 1899.....	100,054,229
Freight ton-miles on Penn. R. R., 1905.....	156,533,351
Increase(56.4 per cent.)	56,479,125
Freight car capacity, Penn. R.R., in 1899, tons.....	2,546,565
Freight car capacity, Penn. R.R., in 1906, tons.....	5,171,485
Increase(more than 100 per cent.)	2,624,920
(Increase in number of cars only 50 per cent.)	
<hr/>	
50-ton cars owned by Penn., Jan. 1....	1905. 1906.
Cars available for freight service, Dec. 1	56,801 71,383
Cars available for freight service, Dec. 1	206,545 221,810
Of these there were on lines East.....	99,926 97,486
" " " " " West.....	49,709 52,482
" " " " " foreign roads.....	56,917 72,010
Foreign cars on Penn., E. and W.....	57,200 56,354
Net loss in one year, 15,939.	
Penn. cars west of Miss. River, Dec. 1.	4,435
West of Miss. cars on Pennsylvania.....	2,523
Men on foreign roads hunting Penn. cars, 30.	
<hr/>	
Cars passing Lewistown Junctn in Oct.	1902. 1901.
	170,558 179,849
<hr/>	
Freight car mileage, P. R.R., 9 mos...835,887,283	1901. 1902.
Increase in 1906, 17.5 per cent.	983,216,237
Millions, frt. ton-miles, P. R.R., 9 mos..	10,776.4 15,142.8
Increase in 1906, 40.5 per cent.	
<hr/>	
Average mileage per car per day in October:	1905. 1906.
	26.06 27.19

In connection with the statement concerning the large number of Pennsylvania cars on foreign roads it is explained that a good many of these cars have been used for shipments of structural steel to the cities of the Middle West. In connection with the comparison of car movement between 1902 and 1906, it is pointed out that the record of 1902 was taken at the height of the famous blockade



Steam Drills at Work in the Bas Obispo Cut.

of that year, whereas the figures for the present year represent the movement under fairly normal conditions. With the great increase in the capacities of cars the increase in the quantity of freight moved was, of course, very much larger than is indicated by the increase in cars, as will be seen from the comparisons next following. The efforts of the officers of the road to reduce delays to freight cars caused by slow unloading have also met with gratifying success. The cars sent out from the North Philadelphia yards on September 6 last had been detained in that yard an average of 6.41 days each. The same average on October 11 was 5.72 and on October 18, 5.03. In Pittsburg, where there is usually the greatest congestion and the freight most difficult to move, August 16 showed a detention of 8.19 days; August 30, 6.65 days; September 13, 6.06; October 4, 5.90; October 11, 5.56, and October 25, 6.08 days.

The Pennsylvania still keeps up its efforts, begun several years

ago, to compel shippers to load bulk freight to the full capacity of the cars. This is usually far from easy, but the enforcement of the rule is persistently followed up. A committee of officers and heads of departments has lately been appointed to expedite the repairing of cars, and on October 29 12,004 cars were repaired in all the freight shops of the companies east and west, the largest day's work of the kind ever done except on October 1, when the figure was 12,065.

It is asserted that while there is great pressure at some points on the Pennsylvania Railroad lines no one anywhere is "suffering" because of lack of cars. The ability of the Pennsylvania to keep freight moving with reasonable freedom from congestion, in spite of the enormous increases shown, is due largely to the new main tracks and new yards that, at enormous expense, have been built during the past four years. These yards, concerning which the readers of the *Railroad Gazette* are already well informed, are at Pitcairn, Hollidaysburg and Enola. These, with the Brilliant cut-off and the additional main line east of the Susquehanna river, furnish facilities for an enormous movement of freight. The plan of making up yard records four times a day and telegraphing them promptly to the superintendents is now in use at Altoona, Baltimore, Buffalo and Olean, and is to be put in use in other yards. This system locates and corrects detentions and contributes materially to the prompt movement of cars.

Mr. Hill on the Railroad Situation.

The President of the Great Northern on January 14 sent a letter to Governor Johnson, of Minnesota, on the traffic needs of the country and the condition of the railroads, an abstract of which is given below:

The business of the United States is to-day so congested that from every portion of the country arises clamor for relief. The railroads everywhere are taxed beyond their power. The people of the United States, therefore, are face to face with the greatest business problem that has ever threatened the nation. During recent years the volume of business has increased, and is increasing with extraordinary rapidity, while the necessary additional trackage and terminals have not been equal to the demands upon them.

The resulting situation is a freight blockade of enormous proportions, especially at all terminal points. How to remedy this is a problem financial, mechanical and physical. No time should be lost in applying such measures of remedy as may be possible, and the first step toward this is to reach a proper understanding of actually existing conditions. The following figures, compiled from the official reports of the Interstate Commerce Commission, and covering the growth of the railroad business for the last ten years, exhibit the significant facts:

	1895.	1905.	Inc., per ct.
Total single track, miles.....	180,667	218,101	21
Locomotives	36,699	48,350	35
Passenger cars	33,112	40,715	23
Freight cars	1,196,119	1,731,409	45
Passenger mileage	12,188,446,271	23,800,149,436	95
Freight, ton-mileage	85,227,515,891	186,463,190,510	118

These figures show the cause of delay in the national traffic movement which threatens to bring industry to a standstill. Within the last ten years the volume of railroad business in this country has increased over 110 per cent. Meanwhile the railroads have endeavored to meet it. Equipment is being increased as rapidly as capital and labor can do it. There are and will be cars enough to carry the country's traffic if the cars can be moved, but engines and cars must have tracks upon which they may run.

A striking tale is told by the statistics of railroad building in the United States. Not only is it true, as stated above, that there has been in the ten years ended 1906 an increase of only 21 per cent in mileage, but the most impressive fact is that railroad building has within a generation fallen off just as the demand upon trackage has increased. At this moment, when that demand is greatest, and the whole country is clamoring for relief, it is the smallest in years. These are the figures:

Year.	Mileage.	Increase.	Increase, per cent.	Increase per cent. pr year.
1870.....	52,898
1881.....	93,671	40,773	77.0	7.0
1894.....	163,597	69,926	74.6	7.46
1904.....	213,904	50,307	30.75	2.19
1906 (estimated).....	220,000	6,250	2.9	1.45

The limit of service of a common carrier has been reached when it has moving at all times over its system as many cars as can be run on its tracks with safety and transferred and dispatched from its terminals and junction points without unreasonable delay. Beyond that point increase of business cannot be handled by increasing cars and engines. The disparity between the growth of traffic and the additions to railroad mileage and the extension of terminals shown by new mileage of less than 1½ per cent. a year since 1904, to take cars of a traffic increase averaging 11 per cent a year for ten years past, presents and explains the real problem. The best judgment of many conservative railroad men in the country is that an immediate addition of not less than 5 per cent. per annum to the railroad trackage of the country for, say five years, should be made to relieve the situation and put an end to unreasonable delays in the transaction of business.

Investigations recently made by public officials and facts accessible before those investigations disclosed that the railroads of the country have been endeavoring to meet the growing demand upon them. In order to handle this enormous addition of 110 per cent. in business with only 21 per cent. more track, they have utilized as never before the carrying capacity of each mile. Not only were there 35 per cent. more locomotives and 45 per cent. more cars in service in 1905 than in 1895, but each engine and car did much more work. The passenger-miles traveled by a locomotive increased from 1,218,

967 to 2,048,558, or more than 68 per cent., and the ton-miles a freight locomotive from 4,258,221 to 6,690,700, or more than 57 per cent. Trains run faster, cars are larger, locomotives are more powerful and methods of handling the business have so improved as to increase the general efficiency.

In the great centres, the inadequacy of terminal facilities prevents the free flow of traffic. The Great Northern has 34 switch engines in use in the Twin Cities, while only 28 engines are used in hauling freight in and out.

Suppose that only 25 per cent. additional track with necessary terminals and equipment, making 33 per cent., is to be built during the next five years; or, say, in round numbers, 75,000 miles of tracks as the requirement for the country to meet immediate needs. No practical man would furnish the facilities required, including additional equipment and terminal facilities for less than \$75,000 a mile. The question of terminals alone is almost prohibitive. Terminals now in use were acquired when property was cheap, and can be enlarged only by heavy outlays. In many cities it is not even a question of cost, since the area necessary to handle railroad business properly is not to be had at any price.

The new work, then, would amount to \$5,500,000,000 in round numbers, or a yearly average of \$1,100,000,000. That is the sum which should be spent before the commerce of the country can be moved properly. It is just twice the total amount of the bonded debt of the United States after the close of the Civil War. It is more than twice the entire currency in circulation in the country, and only a little less than twice the deposits in all the savings banks in the United States put together.

Almost all the complaints made to-day, either by shippers or by operating railroad men of obstacles and dangers in transportation service are due to deficient trackage. The average speed of a freight train is from 12 to 15 miles an hour. The average distance traveled by each freight car is about 25 miles a day. That is, the entire freight equipment of the country is employed to the fair limit of its capacity only two hours out of the 24. On single track lines, freight must wait on sidings while passenger trains have the right of way; cars stand for days or weeks in yards or at transfer points awaiting their turn.

The problem and necessity are enormous. At 140 tons to the mile, it would require 2,000,000 tons of steel rails every year to furnish the 1,500 miles of track required. This is nearly two-thirds of the product of all the rolling mills to the United States. It would call for the labor of 200,000 men in grading, besides track layers, bridge builders and others. Labor, even for such ordinary extensions and improvements as are now being made, is not to be had in sufficient quantities on any terms. And it demands, as has been seen, the investment in permanent railroad plants of \$1,100,000,000 a year for five years to provide the railroads of the country with means to handle properly the business already in sight, not allowing for future growth.

This is the real railroad problem of the United States, and it is one which people have been singularly slow to perceive and reluctant to realize.

Two remedies must be found. The prohibitory expense now attached to enlargement of terminals at many points, and the absolute lack of available space at any price, may be met by a decentralization of traffic. There must be more points for export, more interior markets. A 15-ft. canal or channel from St. Louis to New Orleans would go further to relieve the entire Middle West and Southwest than any other work that could be undertaken. With such a depth of water a single powerful towboat could carry from 30 to 40 train loads.

Terminal troubles admit of a more general diffusion of business, permitting transfers to take place and forwarding to be done where land can be secured in adequate quantities and at more reasonable prices.

To this the traffic systems of the country must be adjusted. The heavy transfers must be made away from the larger cities.

It is not by accident that railroad building has declined to its lowest within a generation, at the very time when all other forms of activity have been growing most rapidly. The investor declines to put his money into enterprises under ban of unpopularity, and even threatened by individuals and political parties with confiscation or transfer to the state. This feeling must be removed and greater confidence be mutually established if any considerable portion of the vast sum necessary is to be available for the work.

Traffic Through the "Soo" Canals.

The following table shows the amount of traffic passing through the United States and Canadian canals at Sault Ste. Marie during the season of 1906:

	1905.	1906.	Inc. or dec., per cent.
Vessels: Steamers, No.....	17,197	18,138	+ 5
Sailing, No.....	3,263	2,817	- 14
Unregistered, No.....	1,219	1,200	- 2
Total No.	21,679	22,155	+ 2
Lockages, No.	13,792	14,523	+ 5
Tonnage: Registered, net.....	36,617,699	41,098,324	+ 12
Freight, net	44,270,680	51,751,080	+ 17
Passengers, No.	54,204	63,033	+ 16
Coal: Hard, net tons.....	984,701	1,011,375	+ 3
Soft, net tons	5,524,355	7,728,255	+ 40
Flour, bbls.	5,772,719	6,495,350	+ 13
Wheat, bush.	68,321,288	84,271,358	+ 23
Grain (other than wheat), bush.....	39,229,553	54,343,155	+ 39
Manufactured and pig iron, net tons...	237,696	391,105	+ 65
Salt, bbls.	423,122	468,162	+ 11
Copper, net tons	106,520	107,633	+ 1
Iron ore, net tons	31,332,637	35,357,042	+ 13
Lumber, M. ft., B.M.	966,806	900,631	- 7
Building stone, net tons	10,899	6,222	- 43
General merchandise, net tons	836,583	1,134,851	+ 36

The United States canal opened for navigation April 13 and closed December 17, a season of 249 days. The Canadian canal opened April 14 and closed December 22, a season of 253 days. Of the total number of vessels passing, 5,680 used the Canadian canal, carrying 6,570,788 tons of freight and 32,108 passengers. The east-bound freight was 41,584,905 tons, and westbound 10,166,175 tons.

GENERAL NEWS SECTION

NOTES.

On January 7 the Florida specials of the Seaboard Air Line, Atlantic Coast Line and Southern Railway made their initial runs.

Two thousand employees of the Chicago, Burlington & Quincy at the Aurora car shops have received a 10 per cent. increase in wages.

Judge Duncan, of the United States Circuit Court, has held that the Maryland "cut-off law" of 1906 will prevent the Baltimore & Ohio from building a freight loop around Baltimore.

The conductors of the Mexican Central have had their pay increased from \$225 a month to \$250, and in some cases more (on passenger trains) and to an average of \$250 on freight trains.

On the Southern Pacific line west of Ogden a practical test is reported to be under way of the rules laid down in the new 16-hour law for railroad employees recently passed by the Senate.

A bill has been introduced in the Massachusetts Legislature providing for the appointment of a special committee to investigate the advisability of cancelling the lease of the Boston & Albany to the New York Central.

The employees of the Ohio Central in Bucyrus have been granted a 10 per cent. increase in pay dating from the first of the year. The increase affects nearly 500 of the local resident employees of the company.

The Wisconsin Railroad Commission has called upon the roads entering Milwaukee for a detailed report of all delays in December, with the causes. The act creating the commission gives it powers to regulate such matters.

In a decision recently rendered, Judge Newman, of the Federal Court, sustained the right of the Georgia Railroad Commission to advance the Southern Railway from Class C to Class B. The effect of the decision is to reduce freight rates 10 per cent. within the state.

Bids for building the Panama Canal by private contract were opened at Washington, January 12. The lowest bid was that of W. J. Oliver and A. M. Bangs, who offered to do the work for a compensation of 6.75 per cent. of the money expended by the Government in the work.

Railroad traffic in the Canadian Northwest is said to be demoralized and many local trains have been canceled. The Canadian Pacific transcontinental limited train carrying the Japan and China mails has been over 24 hours late in making connection with the Atlantic steamer at St. Johns, New Brunswick.

Chicago's share of the net receipts from the traction companies provided for under the proposed settlement ordinances has averaged \$3,645.07 a day since the first of January. This average would mean \$1,330,430.55 a year. Both traction companies opened new books the first of the year with the city as a partner in the transportation business.

The Nashville, Chattanooga & St. Louis has taken the ground that issuing transportation between two points on its lines within the state, although the train passes through parts of other states, is not a violation of the Interstate Commerce Law and that the issuance of such passes is not under the jurisdiction of the United States government.

Captain James E. White, General Superintendent of the Railway Mail Service, has resigned on account of ill-health. He has been in the service for more than 40 years and for the last 16 years has been General Superintendent. It is said that Alexander Grant, of Michigan, will succeed him. Mr. Grant has for a long time been assistant to the general superintendent.

It is announced that a 23,700-ton steamship named the Rotterdam, is being built for the Holland-America Line by Harland & Wolff, Belfast. Every inside and outside room on the saloon deck will have an adjoining private bath-room. It is expected that the Rotterdam will be launched in the latter part of this year, and make her maiden trip to New York, in April, 1908.

Governor Chamberlain, in his message sent to the Oregon legislature January 15, urges with great emphasis the enactment of a law creating a state railroad commission, clothed with adequate powers. No state has been so liberal as Oregon, he says, in its

policy toward the railroads, though "rich sections of the state have been left neglected by the one great railroad system which practically controls its whole transportation business."

The city of Spokane, the Chamber of Commerce and the Spokane Jobbers' Association have filed suits against the Great Northern, the Northern Pacific and the Oregon Railroad and Navigation and allied lines. The complaint charges unjust discrimination in freight rates, in that rates on goods shipped from Eastern points to Spokane are based on the through rate from the East to the Pacific Coast, plus the return rate from the coast to Spokane.

Continued snowstorms and heavy winds are piling the tracks in North Dakota and Montana with such drifts that it is almost impossible to get trains through. Drifts are said to be ten feet high on each side, and the snow accumulates faster than it can be shoveled away. Considerable anxiety is expressed in St. Paul for the passengers on trains which have been stalled two or three days in North Dakota. Fuel and provisions are being provided by the neighboring villages.

Governor Deneen, of Illinois, sent a special message to the Legislature January 10 recommending an emergency appropriation of \$150,000 for the purpose of preparing and trying a suit against the Illinois Central Railway Company to collect back taxes. These taxes, it is claimed, are due the state under a provision of the road's charter, the provision requiring payment of 7 per cent. of the road's gross earnings yearly to the state. President Harahan denies that the road is in default.

By a vote of 107 to 0 the lower house of the Minnesota legislature adopted a resolution January 15 directing a legislative investigation of the transaction by which J. J. Hill, president of the Great Northern Railroad, sold certain ore lands to the United States Steel Corporation. Representative Knutson, who introduced the resolution, said the transaction was practically a railroad deal, and that the Great Northern Railroad Company's charter did not permit the company to deal in ore lands.

Oren Root, General Manager of the New York City Railway, is quoted as saying that the nuisance of flat wheels on the cars of the system would probably be removed in the near future by substituting steel wheels for the cast iron ones now in use. In the meanwhile the company is coping with the difficulty by removing wheels found to be defective, and has sent a statement to Dr. Darlington, of the Health Department, showing that 1,568 such changes were made on the electric cars in the month of December.

Senator Hansbrough has given notice that he will offer this amendment to the bill S 5133 to promote the safety of travelers: "That it shall be unlawful for any interstate railroad to move any train or trains from one point to another containing tonnage in excess of the registered capacity of the engine or engines attached thereto. Any officer, agent, or employee of any such railroad who violates the provision of this section shall be deemed guilty of a misdemeanor and punished by a fine not exceeding \$1,000 for each offense."

The switchmen on the Toledo Terminal Railway inaugurated a strike January 11, completely tying up that road. The tie-up is the result of the company's refusal to grant an increase in wages of about 30 per cent. Heretofore the wages of switchmen have ranged from 23 to 29 cents an hour, but the new schedule calls for a graded scale, ranging from 32 to 36 cents an hour. There is no present prospect of settlement. The Toledo & Ohio Central also is considering an increase wanted. All the other Toledo roads are said to have met the demands of the men.

The Virginia Corporation Commission handed down a report January 14 on its investigation of alleged negligence of the Southern Railway relative to the collision near Lawyers, Va. The report takes up the whole subject of negligence, and says that the full measure of deterrent law will not be reached until the hand of such law has been laid heavily upon the person, be he president, manager or brakeman, whose negligence or infidelity has brought death and suffering to his fellowmen. It holds Mattox, the operator at Rangoon, immediately responsible, but puts primary responsibility on the whole management.

On January 4 the railroad presidents located at Chicago made a personal appeal to the Chicago Commercial Association to join hands with them in a friendly and united attempt to improve the existing transportation conditions and relieve the present car shortage. The same day a convention of shippers representing forty associations in some 20 different states went on record emphatically in favor of reciprocal demurrage by passing a resolution that it was the sense

of the convention that congress should pass a federal law indorsing and making it the duty of the Interstate Commerce Commission to make proper rules for reciprocal demurrage.

The Senate, by a vote of 70 to 1, passed the Railway Hours bill January 10. The bill, as passed, prohibits railroads engaged in interstate and foreign commerce from requiring or permitting those of their employees who have to do with the movement of trains to work more than 16 hours consecutively, nor an aggregate of more than 16 in each 24 hours, and requires that when an employee shall have worked for 16 hours there shall follow a period of rest of not less than 10 hours before the employee shall resume his duties. Certain exceptions are made to provide for accidents, the failure of trains to make their regular schedules, connections, etc. Violation of the act is declared to be a misdemeanor punishable by fine of from \$100 to \$1,000, and the Interstate Commerce Commission is charged with the duty of enforcing the law, and all authority necessary to do so is given it.

Trolley Roads Not for the Boston & Maine.

The general attitude of the Boston & Maine in regard to the acquisition of electric roads has been defined in the following statement by President Tuttle:

Whatever the policy of the New Haven road, that of the Boston & Maine is strongly opposed to the wholesale absorption of trolley lines. I have found that when you provide a market for electric lines they are built almost as fast as the public highways will accommodate them. The Boston & Maine does not intend to constitute itself a market to which trolley promoters may take their securities.

So far as any interest in the Massachusetts Electric Co. is concerned, the Boston & Maine has never owned, directly or indirectly, a share in the stock of this corporation, and has no disposition to obtain any interest in it whatsoever. If the New Haven road wants the Massachusetts Electric Co., either the whole or any part, it is welcome to buy it without opposition from the Boston & Maine.

Where the trolley can be made a feeder to the steam road the latter may here and there find it to its interest to own the electric line, but the Boston & Maine is not seeking to buy up competing or parallel roads.

Exports of Grain in 1906.

The amount and value of various grains exported during the calendar year 1906 and also the corresponding figures for the previous year are as follows:

	1906		1905	
	Quantities.	Values.	Quantities.	Values.
Wheat	62,848,437 bush.	\$49,134,718	20,555,817 bush.	\$16,907,480
Corn	102,168,235 "	52,658,474	110,928,065 "	59,946,752
Barley	14,358,218 "	7,245,347	13,363,921 "	6,706,920
Oats	25,480,162 "	9,322,213	28,641,633 "	9,915,068
Rye	1,072,251 "	717,626	470,230 "	304,673
Wheat flour ...	14,261,115 bbls.	58,138,598	11,281,379 bbls.	49,691,762

Total breadstuffs \$180,462,232 \$146,107,883

Exports of canned beef fell off 74,752,361 lbs. in 1905 to 35,410,679 lbs. last year, probably as a result of the packing house scandals.

Steamship Connections for the Tehuantepec Route.

By an arrangement made between the American-Hawaiian Steamship Company and the Tehuantepec National Railroad which, with its two terminal harbors—one on each side of the Isthmus of Tehuantepec—is to be formally opened for operation this month, the service of the steamship company through the Straits of Magellan has been discontinued, and the company plans to have weekly sailings from New York to Coatzacoalcas, the Atlantic terminal of the Tehuantepec road. Through freight will from there be carried by rail to Salina Cruz, the Pacific terminal, where it will be loaded on the American-Hawaiian Company's steamers for coast ports and Hawaii. The Pacific boats will make a triangular trip, beginning at Salina Cruz, thence north along the coast to San Francisco with general cargo, thence to Honolulu with general cargo, and from Honolulu to Salina Cruz with sugar and other products. By this arrangement it is expected that the Hawaiian sugar that has been carried via the Straits of Magellan will now be carried by the Tehuantepec route. These shipments amount to nearly 300,000 tons.

Fuel Scarcity in the Northwest.

In view of cumulative reports of fuel scarcity in North Dakota, the Interstate Commerce Commissioners, upon their return to the city to-day, again took up the matter, and a despatch was sent to President Hill, saying:

"Upon return to office this afternoon found telegrams indicating acute and serious situation at Clyde, Hannah, Milton, and Park River. Senator Hansbrough, in letter to-day to Commission indicates lack of foodstuffs as well as coal, and urges abandonment of other traffic if necessary to give immediate relief. I assume that you will keep in close personal touch with the situation and take effective measures to rush supplies where needed regardless of expense or other sacrifice."

Senator Hansbrough's letter said:

"My advices from North Dakota are alarming: It is reported to me that many farmers are killing their stock to prevent their starving; that the lights in more than one hundred villages were extinguished several days ago, and that the prospect for relief from

the fuel famine grows less day by day. If these conditions continue indefinitely, supplies of provisions will soon be exhausted, and this will add to the prevailing distress."

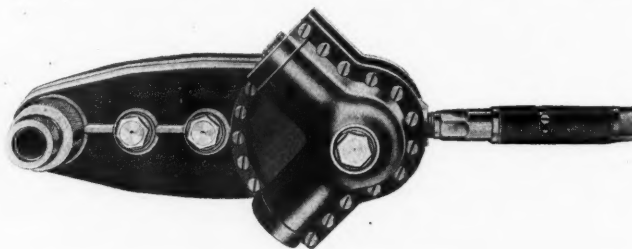
The following notice has been received at the Great Northern station at Fergus Falls, Minn., and it is understood that similar notices have been sent to agents all along the line:

"Superintendents have been instructed and authorized to furnish coal to people at any station on the Great Northern where they are short or actually suffering for lack of fuel. If your station is out of coal, you should promptly notify your superintendent."

Mr. Hill is quoted as saying that in 35 years he has not seen weather conditions as severe as those now prevailing in North Dakota and other points west of St. Paul. "The snow on the level out there is from three to four feet deep, and that means something. Men cannot walk on it without snowshoes, and it is impossible for horses to travel. There are some places along our line where the snow is from 10 to 25 feet deep, and then there are places where all we can see of a freight car is the brake wheel sticking up out of the snow. We will have to dig those cars out. We have had from 1,200 to 1,500 men working along our line, and have kept it open, but part of the time the weather has been so cold that the men could not work."

"Little Giant" Corner Drill.

A new type of pneumatic drill for work in close quarters, and especially in corners, has recently been put on the market by the Chicago Pneumatic Tool Co. It is compact, simple and powerful



Little Giant Corner Drill.

and weighs only 35 lbs. Under load the spindle has a speed of 100 r.p.m. with 80 lbs. pressure, and when running light has a speed of 150 r.p.m. It will drive 1½-in. twist drills and in emergency cases 2-in. drills. There are four pistons working on a common shaft, and the rotation is geared down through a chain of four gears and pinions to the spindle. This insures positive spindle movement. All the parts are interchangeable with the No. 4 "Little Giant" drill. The limiting dimensions are 5⅞ in. from end of socket to point of feed screw when run down, feed 2 in., distance from outside of housing to center of spindle, 1 ⅞ in.

A New Buffalo Outdoor Forge.



Buffalo Outdoor Forge.

A new design of outdoor forge has been placed on the market by the Buffalo Forge Company, Buffalo, N. Y. In interior construction it is not unlike the company's new direct drive blower, the blast being provided by a fan wheel operated by gearing driven through a noiseless clutch motion from a hand lever. The horizontal cross section of the body of the machine is semi-elliptical. The handle is fastened by a chain so that it can be detached and slipped inside the body of the forge, and cannot get lost. With the handle slipped out of the socket and inside the casing, the dash hood lowered forming a cover to the fire pan, within which tools may be placed, and the cover padlocked to the barrel of the forge, the smith's tools are safe from being stolen during the night or during shipment. The weight is 125 lbs.

Municipal Accounting.

By a notable coincidence, the deficit in the first year's operation of New York's municipal ferry is very nearly the same as that of the steamboat service on the Thames, maintained by the London county council. Commissioner Benschel estimates the city's loss on the Staten Island ferry as \$250,000. The loss on the Thames boats was £53,000. The cases differ, of course, but are alike in illustrating the need of that distinction between ordinary commercial accounting and municipal accounting, upon which G. Bernard Shaw gravely insists. He admits that if the usual tests of bookkeeping were applied, many a municipal enterprise would wear an unhappy air of bankruptcy. But the skilled municipal accountant argues the whimsical but, apparently, this time serious, Mr. Shaw—we refer to his book on "Municipal Socialism"—must reckon in the "invisible profits." This means that he must rise above mere sordid shillings

and pence and figure in the satisfaction which cannot be stated in terms of money. We must not omit, for example, the content of the employees who are given good and regular wages, though at work in an industry not self-supporting; we must also consider the gratification of the citizens in carrying on an enterprise themselves, even if they do it badly. By a little of such hocus-pocus with invisible profits, a municipal deficit may be made to look like a surplus. The only one who will surely have doubts about the process is the taxpayer. However it may be with profits, his taxes are painfully visible.—*New York Evening Post*.

Latest Fashions in Passes.

In issuing passes to members of the legislatures the Great Northern and Northern Pacific have specified that the passes are "only good for a trip wholly within the state."

The Harriman lines will continue to sell tickets to army officers and clergymen at half fare, but only for trips within a single State.

The Wabash will exchange passes for advertising in country newspapers, but the passes are only good in one state.

Pullman passes, good only in New York state, have been received by members of the New York legislature. They are made in the name of "Mrs. ——— and one."

Railroads in Illinois have given the legislators of that state passes good within the state of Illinois.

The Rock Island will make no more contracts to exchange transportation for advertising.—*Railway World*.

The First Railroad Train in Morocco.

On December 15 the first train ran over the new narrow-gauge railroad to the quarries built by the German Harbor Construction Company. The railroad, the first in Morocco worked by steam traction, is 2 kilometers (1¼ miles) long.

Freight Congestion in the Northwest.

In discussing the congestion of traffic on northwestern roads, Mr. Hill made the following comment at the opening session of the Northwestern Lumbermen's Association at Minneapolis, January 15:

"At this time, when the lumber business is a constantly increasing factor, the lumber trade of the country is being concentrated on the forests of Washington and Oregon. I was talking to the president of the Northern Pacific within a month. Their capacity is measured by the tunnel through the Cascade range. Everything working fairly, good grade and good rails, they can get from 300 to 350 cars a day in each direction, and that is all they can move through that hole, and often they are called on to move 600 or 700 cars a day.

"The remedy to-day is more trackage facilities, and we cannot increase those facilities without more money. It is not more cars, but more movement of the cars already in use which will solve the car shortage problem."

Better Grain Rates Wanted by Boston.

The following comment on Boston grain rates is taken from the annual report to the directors of the Chamber of Commerce:

While all the North Atlantic ports are suffering to a greater or less degree from the rapid growth of the grain exporting business of the Gulf ports, Boston's grain business makes a relatively poor showing, as compared with those Atlantic ports enjoying the differential rates fixed by the Interstate Commerce Commission at the time of the decision made in 1905. If Boston is to retain any fair proportion of the North Atlantic business in competition with these ports and with the St. Lawrence and provincial ports, a readjustment of these rates must eventually be made.

Corporation Legislation Favored by McCrea.

James McCrea is quoted as expressing the belief that free railroad chartering throughout the states should be abrogated and the commerce commission empowered to say whether proposed new roads are needed in the interests of trade and commerce in their respective districts. Furthermore, Mr. McCrea has a remedy which he believes would be effectual in preventing the watering of stock. He would restore a provision formerly in effect, but which has for many years fallen into disuse, whereby there should be inserted in every charter issued a statement describing specifically what shall constitute a controlling vote. This he would not have uniform in all cases, but made to vary according to the necessities of each charter issued.

New Steamship Line to Greece.

A new steamship line is to be established between the Piraeus and the United States to accommodate the increasing tide of emigration. The service will be begun about April 10, and three new ships are being built, which will make regular trips.

TRADE CATALOGUES.

Ingersoll-Rand Co.—Catalogue No. 91 illustrates and describes the Davis calyx diamondless core drill. It is a prospecting drill producing cores from 1½ to 15 in. in diameter to depths down to

6,000 ft. It does not use diamonds and the cost of the entire apparatus is often less than that of the diamonds alone where they are employed, and the cost of diamond maintenance and replacement is entirely eliminated. It gives a double record, depositing the cuttings successively as they occur and removing the core in convenient lengths. For ordinary materials a rotating toothed steel cutter is used, this having a chattering action instead of a smooth cut, and for the harder materials chilled steel shot are used as an abrading material. The apparatus is built in different sizes, the smallest operated by hand, and the largest requiring 20 or more horse-power and capable of removing cores of large diameter from a great depth.

The Southern has issued an unusually attractive four-page folder about its Palm Limited, which began running January 7. This gives a colored picture of a scene in Florida, a map of the route of the train, condensed time-tables, and, most striking of all, detailed diagrams showing the separate berths and staterooms of each of the seven cars which make up the train.

Manufacturing and Business.

C. A. Wales has been appointed Purchasing Agent of the Federal Railway Signal Company at the works, Troy, N. Y.

The British Westinghouse Electric & Manufacturing Company, whose offices are at Manchester, England, is to reduce its capital by \$5,000,000.

The year 1906 proved to be a specially good one for the Falls Hollow Staybolt Company. It reports a volume of business 50 per cent. greater than for any previous year.

On December 26, 1906, the corporate name of the Cook's Railway Appliance Company was changed to Cook's Standard Tool Company. The ownership and management remain the same.

The Glidden Varnish Company, Cleveland, Ohio, has increased its capital stock from \$200,000 to \$1,000,000. The additional funds will be used to provide for further extension of the company's business.

H. H. Newsom, formerly with the Victor Stoker Company, has been appointed sales agent for the Locomotive Appliance Company, with headquarters at the general offices of that company, 490 Old Colony Building, Chicago.

The Power Specialty Company, 111 Broadway, New York, has opened an additional branch office, 1012 Chemical Building, St. Louis, Mo. The company has recently received a number of large orders for installing the Foster superheater which it makes.

The B. F. Sturtevant Co., Boston, Mass., is installing complete blower systems for heating and ventilating the 18-stall roundhouse of the Canadian Pacific Railway Co., Broadview, Saskatchewan, P. Q., and the car repair shops of the Somerset Railway Co., Oakland, Me.

William J. Clark, General Manager of the Foreign Department of the General Electric Company, has been appointed by the Governor of New York as a delegate from that state to the national convention for the extension of foreign commerce of the United States, which was held in Washington, D. C., beginning January 14.

J. W. Duntley, President of the Chicago Pneumatic Tool Company, sailed for Europe on January 8 to close a number of important contracts for pneumatic tools and appliances. During the past year a number of large European manufacturers made exhaustive tests of the products of this company, and are ready now to finally place their orders.

Howard M. Post has been appointed Advertising Manager for the Quincy, Manchester, Sargent Co., Chicago. He formerly was a telephone engineer with the Western Electric Co., Chicago, and was later with the Kellogg Switchboard & Supply Co., Chicago, first in telephone work for five years and then as advertising manager for a number of years. He left the latter position to go to the Quincy, Manchester, Sargent Co.

H. J. Lamborn has been appointed Superintendent of Power & Plant at the works of the Yale & Towne Manufacturing Company, succeeding F. A. Waldron, who resigned about a year ago. He was formerly Mechanical Engineer and Superintendent of the magnetic separating plants of Witherbee, Sherman & Company at Mineville, N. Y. S. E. Dauchy, who has been Acting Superintendent of Power and Plant, has been made Assistant Superintendent under Mr. Lamborn.

Colonel John T. Dickinson has severed his connection with the Consolidated Railway Electric Lighting & Equipment Company to become Vice-President of the Bliss Electric Car Lighting Company of Milwaukee, with headquarters in New York at the new offices of the company in the Night and Day Bank Building, Fifth avenue and 44th street. The Chicago office of the Bliss Electric Car Lighting Company will be in the Monadnock Building, with W. N. Lalor, formerly also with the Consolidated Railway Electric Lighting &

Equipment Company, in charge as Assistant General Sales Manager. The extensive additions to the large plant of the Bliss Electric Car Lighting Company will be completed February 1.

The Otis Elevator Company has been given a contract by the New York & Long Island Railway, the company which is building the Belmont tunnel between Forty-second street and Long Island City, for the two largest escalators ever built to be used in the Manhattan terminal of the tunnel railroad at Forty-second street between Lexington and Third avenues. It is believed that these escalators will have a capacity equal to the entire stairway equipment of the Manhattan terminal of the Brooklyn bridge. They will provide service between levels about 55 ft. apart. Most of the time one will be operated going up and the other going down, but during the morning rush hour both will be operated going up.

The firm of Charles Hansel & Company, bankers, engineers and investigators, has been established with offices at 43 Wall street, New York. They will furnish bankers and investors with plans, reports and exact information concerning the physical condition of existing or projected railroads, water powers and industrials. They are prepared also to analyze and complete statistics, to report on inventions and carry on engineering work in its various branches. The value of such a firm to its customers depends entirely upon the qualifications of the chief member of the firm. There are few engineers in the United States who have had a more varied service than has Mr. Hansel. He has been chief engineer of many important undertakings aside from railroads. He was consulting engineer for the Illinois Railroad and Warehouse Commission. For a considerable period he made a specialty of signaling, and four times he was sent to England and the Continent to make investigations. In connection with legislation, he formulated the rules relating to interlocking, which were embodied in the laws of Illinois, Ohio, Indiana, Texas and Canada. He has also done much work, and may be classed as an expert, in plans and estimates for factories, systems of cost finding and factory accounting and economic operation. We are mentioning only a few of his fields of activity in the past, but they have been so wide and so varied as to well qualify him for the consulting engineering work which he is now undertaking.

Iron and Steel.

The San Antonio & Aransas Pass has ordered 7,000 tons of rails.

The South Dakota Central has given orders for 6,000 tons of rails, and the Minneapolis & Rainy River for 1,300 tons.

The Great Northern has ordered 1,500 tons of steel and the Chicago, Rock Island & Pacific 700 tons of steel for bridges from the American Bridge Company. The Denver & Rio Grande has ordered 950 tons of steel for bridge work from the Pennsylvania Steel Company, and the Chicago & North-Western 350 tons for station work.

There is a large demand for steel for industrial and commercial buildings principally in Chicago, where about 30,000 tons will be used, and in San Francisco about 8,000 tons. A number of railroads are in the market for large quantities of bridge material. About 30,000 tons of steel will be required to complete steel cars and locomotives recently ordered by the railroads.

OBITUARY NOTICES.

George Erbeling, Secretary of the St. Louis Southwestern, died at his home in Brooklyn on January 10 at the age of 43.

Thomas W. Dodd, Vice-President and General Attorney of the Texas-Mexican Railway, a subsidiary of the National of Mexico, and General Attorney for Texas of the National Lines of Mexico, died at Laredo January 13 after a long illness. He was born in 1840 in Georgia, and graduated from the University of Georgia in 1868. He had held his present position since 1888.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

New York Railroad Club.

At a meeting of this club to be held January 18, an address, illustrated with lantern slides, will be made by Clarence L. Chester on the Isthmian Canal.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Central of Georgia.—W. C. Askew, Assistant Treasurer, has been elected Treasurer of the Central of Georgia and of the Ocean Steamship Company, succeeding T. M. Cunningham.

Great Northern.—William R. Begg, Assistant General Solicitor, has been appointed General Solicitor, with headquarters at St. Paul, Minn. Mr. Begg is a graduate of Yale College, class of 1893.

Illinois Central.—H. G. Hackstaff, Third Vice-President and Secretary, has been elected Vice-President in charge of the New York office of the company. W. J. Harahan, Fourth Vice-President, has been elected Vice-President, with headquarters at Chicago, in charge of the traffic and construction departments. I. G. Rawn, General Manager, has been elected Vice-President, with headquarters in Chicago, in charge of the operating department.

Macon, Dublin & Savannah.—Alfred Walter, President of the Seaboard Air Line, has been elected President, succeeding Thomas K. Scott.

New York, New Haven & Hartford.—James McCrea, President of the Pennsylvania, has been elected a Director, succeeding the late Alexander J. Cassatt.

Overton County.—George L. Wilkins, of Chicago, has been elected President, succeeding H. E. Overstreet.

Seaboard Air Line.—See Macon, Dublin & Savannah.

Temiskaming & Northern Ontario Railway Commission.—Frederick Dane has been appointed a member of the Commission, succeeding Cecil B. Smith, resigned.

Vandalia.—Joseph Wood, First Vice-President of the Pennsylvania Lines West, has been elected President, succeeding James McCrea. J. J. Turner, Second Vice-President; E. B. Taylor, Third Vice-President, and D. T. McCabe, Fourth Vice-President of the Lines West, have been elected First, Second and Third Vice-Presidents respectively of the Vandalia.

Operating Officers.

Baltimore & Ohio.—Frank C. Batchelder, who has been appointed General Superintendent, with headquarters at Baltimore, of the Baltimore & Ohio, was born on May 27, 1857, at Fall River, Wisconsin. After a common school education he entered railroad service on April 14, 1874, as an operator on the Chicago, Milwaukee & St. Paul. He was on that road until April, 1888, as agent, despatcher and chief despatcher. In 1888 he went to the Minneapolis, St. Paul & Sault Ste. Marie as despatcher, later becoming Assistant Superintendent and Superintendent. From June 30, 1899, until January 1, 1907, the date of his recent appointment, he was Superintendent on the Baltimore & Ohio.

Chicago, Rock Island & Gulf.—See Rock Island Lines.

Chicago, Rock Island & Pacific.—See Rock Island Lines.

Denver & Rio Grande.—D. E. Cain, formerly General Manager of the Southwestern and Choctaw districts of the Rock Island Lines, has been appointed Assistant to the resident Vice-President at Denver.

Lake Erie & Western.—H. A. Boomer, Assistant General Superintendent, has been appointed General Superintendent of the Lake Erie & Western and the Northern Ohio, with headquarters at Indianapolis.

Louisville & Nashville.—Fred H. Benjamin, Trainmaster at Nashville, has been appointed Inspector of Transportation, a new position, with headquarters at New Orleans. His jurisdiction will run as far north as Decatur, Alabama.

Merchants' Despatch Transportation Company.—W. B. Pollock, Manager of the Foreign Freight and Marine departments of the New York Central & Hudson River, has been appointed also General Manager of the Merchants' Despatch Transportation Company, succeeding as General Manager, Arthur Mills, deceased.

Missouri, Kansas & Texas.—T. F. Gardner has been appointed Trainmaster of the Choctaw division, succeeding T. A. Wilson, resigned.

Rock Island, Arkansas & Louisiana.—See Rock Island Lines.

Rock Island Lines.—The following changes in divisions and districts were effective January 15, 1907:

Minnesota division—Cedar Rapids (mile post 100) to Minneapolis; Vinton to south yard limit board, Estherville. Office at Cedar Rapids, Iowa.

Cedar Rapids and Dakota divisions—These divisions are to remain as at present, with the exception of the territory that is withdrawn to form the Minnesota division.

Des Moines Valley division—This division to remain as at present, with the exception that the Winterset and Indianola branches are added.

The Northern district is composed of the Cedar Rapids, Minnesota, Dakota, Des Moines Valley and Iowa divisions; office at Cedar Rapids, Iowa.

Iowa division—This division to remain the same as at present, with the exception of the territory that is withdrawn and added to the Des Moines Valley division.

Arkansas division—Memphis to Booneville (east yard limit board); Brinkley to Jacksonport; Wiville to Gregory; Mesa to Searcy; Little Rock to Hot Springs; Butterfield to Malvern. Office at Little Rock, Ark.

Indian Territory division—Booneville to Shawnee (west yard limit board); Haileyville to Ardmore; Tecumseh Junction to Asher. Office at Haileyville, Ind. T.

Louisiana division—Haskells to Wirand; Tinsman to Crossett. Office at Ruston, La.

The Choctaw district is composed of the Arkansas, Louisiana and Indian Territory divisions; office at Little Rock, Ark.

Oklahoma division—Caldwell (south yard limit board) to Chickasha (south yard limit board); Shawnee to Geary (east yard limit board); Chickasha to Mangum; Kingfisher to Chandler; North Enid to Billings; Chickasha to Lindsay. Office at Chickasha, Ind. T.

Pan-Handle division—Geary to Texola; Enid to Anadarko (north yard limit board); Geary to Anthony; Ingersoll to Alva. Office at Geary, Okla. T.

Fort Worth division—Chickasha to Terral; Waurika to Anadarko (south yard limit board); Lawton to Chattanooga. Office at Fort Worth, Tex.

The Southern district is composed of the Oklahoma, Pan-Handle and Fort Worth divisions; office at Fort Worth, Tex.

Southern.—R. A. Dugan having resigned to engage in private business, the office of Assistant General Manager has been abolished. P. L. McManus, Superintendent of the Charlotte division, has been appointed Assistant to General Manager, with office at Washington, D. C.

The operating divisions as recently reorganized, including the new divisions which were created, and the officers of each division are as follows. Each district is in charge of a General Superintendent:

Washington division—Washington, D. C., to Monroe, Va.; Bluemont, Warrenton and Harrisonburg branches and Monroe terminals. C. S. Lake, Superintendent, with headquarters at Alexandria, Va.

Danville division—Monroe, Va., to Spencer, N. C.; Rocky Mount and Asheboro branches and Danville terminals. W. S. Andrews, Superintendent, with headquarters at Greensboro, N. C.

Richmond division—Neapolis to West Point, Va. W. T. West, Superintendent, with headquarters at Richmond, Va.

Norfolk division—West Norfolk to Danville, Va.; Pinners Point, Va., to Selma, N. C.; Claremont, Hitchcock, Buffalo Lithia Springs, Portsmouth and Copper Mines branches. E. T. Lamb, Superintendent, with headquarters at Norfolk, Va.

Durham division—East Durham, N. C., to Keysville, Va.; Oxford to Henderson, N. C.; Greensboro to Goldsboro, N. C.; University to Chapel Hill, N. C. G. V. Peyton, Superintendent, with headquarters at Durham, N. C.

Winston-Salem division—Mt. Airy to Sanford, N. C.; Climax to Ramseur, N. C.; Wilkesboro to Greensboro, N. C., including Winston-Salem terminals; Stokesdale to Madison, N. C.; Mt. Airy to Granite Quarry, N. C. J. M. Bennett, Superintendent, with headquarters at Winston-Salem, N. C.

Mooreville division—Mooreville Junction to Winston-Salem, N. C.; Charlotte to Taylorsville, N. C. D. W. Newell, Superintendent, with headquarters at Winston-Salem, N. C.

The Northern district consists of the Washington, Danville, Richmond, Norfolk, Durham, Winston-Salem and Mooreville divisions.

Charlotte division—Spencer, N. C., to Greenville, S. C., including Spencer terminals; Whitney, Norwood and Union Copper Mines branches. P. L. McManus, Superintendent, with headquarters at Charlotte, N. C.

Greenville division—Greenville, S. C., to Armour, Ga.; Elberton, Athens and Roswell branches and Greenville terminals. J. A. Heether, Superintendent, with headquarters at Greenville, S. C.

Rock Hill division—Marion, N. C., to Kingville, S. C., including Rock Hill terminals; Sumter Junction to Sumter, S. C.; Blacksburg to Gaffney, S. C. J. H. Herne, Superintendent, with headquarters at Rock Hill, S. C.

Columbia division—Charlotte, N. C., to Savannah, Ga.; Batesburg to Perry, S. C.; Cayce, S. C., to Augusta, Ga.; Edgefield to Aiken, S. C.; Columbia terminals. H. A. Williams, Superintendent, with headquarters at Columbia, S. C.

Charleston division—Charleston to Columbia, S. C.; Branchville, S. C., to Augusta, Ga.; North Augusta and Navy Yard branches and Augusta terminals. A. G. Jones, Superintendent, with headquarters at Charleston, S. C.

Spartanburg division—Columbia to Spartanburg, S. C.; Alston to Greenville, S. C.; Abbeville, Lockhart and Ware Shoals branches. R. E. Simpson, Superintendent, with headquarters at Columbia, S. C.

Jacksonville division—Savannah, Ga., to Jacksonville, Fla. W. L. Pierce, Superintendent, with headquarters at Jacksonville, Fla.

The Eastern district consists of the Charlotte, Greenville, Rock Hill, Columbia, Charleston, Spartanburg and Jacksonville divisions.

Asheville division—Salisbury to Asheville, N. C.; Biltmore, N. C., to Spartanburg Junction, S. C.; Hendersonville to Lake Toxaway, N. C.; Asheville terminals. A. Ramseur, Superintendent, with headquarters at Asheville, N. C.

Murphy division—Murphy Junction to Murphy, N. C. T. S. Boswell, Superintendent, with headquarters at Bryson, N. C.

Knoxville division—Asheville, N. C., to Morristown, Tenn.; Bristol to Knoxville and Coster, Tenn.; Embreeville and Rogersville branches; Coster and Knoxville Belt. C. L. Harris, Superintendent, with headquarters at Knoxville, Tenn.

Coster division—Coster to Jellico, Tenn., and Middlesboro, Ky.; Clinton to Harriman Junction, Tenn.; La Follette, Clear Fork, Big Mountain, Coal Creek and Bennett's Fork branches. E. E. Norris, Superintendent, with headquarters at Knoxville, Tenn.

Chattanooga division—Knoxville to Chattanooga, Tenn.; Austell, Ga., to Ooltewah Junction, Tenn.; Attalla, Cleveland and Cedar Bluff branches and Chattanooga terminals. C. C. Hodges, Superintendent, with headquarters at Chattanooga, Tenn.

Nashville division—Harriman to Nashville, Tenn.; Isoline, Crawford and Carthage branches. F. P. Pelter, Superintendent, with headquarters at Nashville, Tenn.

Memphis division—Chattanooga to Memphis, Tenn.; Florence and Somerville branches. H. E. Hutchens, Superintendent, with headquarters at Memphis, Tenn.

The Middle district consists of the Asheville, Murphy, Knoxville, Coster, Chattanooga, Nashville and Memphis divisions.

Birmingham division—Birmingham, Ala., to Columbus, Miss.; Woodlawn-Bessemer Branch; Coalburg Loop and Birmingham terminals; Ensley Southern Railway. W. M. Deuel, Superintendent, with headquarters at Birmingham, Ala.

Mobile division—Selma to Mobile, Ala.; Marion Junction to Meridian, Miss., and Akron, Ala. J. H. Stanfel, Superintendent, with headquarters at Selma, Ala.

Selma division—Atlanta Junction (Rome, Ga.) to Selma, Ala.; Wilton to Birmingham, Ala.; Frog Mountain, Masena, Lapsley, Piper, Belle Ellen and Blocton branches. J. Lasseter, Superintendent, with headquarters at Wilton, Ala.

Atlanta division—Atlanta, Ga., to Birmingham, Ala.; Atlanta Belt and terminals. A. H. Westfall, Superintendent, with headquarters at Atlanta, Ga.

Columbus division—Atlanta to Fort Valley, Ga.; McDonough to Columbus, Ga. W. J. Bell, Superintendent, with headquarters at Williamson, Ga.

Macon division—Brunswick to Atlanta, Ga.; Hawkinsville branch. F. J. Egan, Superintendent, with headquarters at Macon, Ga.

The Western district consists of the Birmingham, Mobile, Selma, Atlanta, Columbus and Macon divisions.

W. H. Gatchell, Superintendent of the old Nashville division, has been appointed Superintendent of Transfers, with headquarters at Washington, D. C.

Union Pacific.—W. H. Jones, Trainmaster of the Idaho division of the Oregon Short Line, with headquarters at Pocatello, Idaho, has been appointed Assistant Superintendent at that point. J. P. Folger, Chief Despatcher at Kemmerer, Wyo., has been appointed Trainmaster of the First district and of the Wyoming Western, with headquarters at Kemmerer.

Traffic Officers.

Chicago, Burlington & Quincy.—E. A. Abbott, Southwestern Passenger Agent at Kansas City, has been appointed Advertising Agent of the Burlington System, with headquarters at Chicago.

Erie.—D. W. Cooke, Assistant General Traffic Manager, with headquarters at New York, has been appointed General Traffic Manager with headquarters at Chicago. The office of S. P. Shane, Freight Traffic Manager, has been moved from Chicago to New York.

Nashville, Chattanooga & St. Louis.—W. I. Lightfoot, chief rate clerk in the passenger department, has been appointed Assistant General Passenger Agent, succeeding W. F. March, deceased.

New York Central & Hudson River.—Milton C. Roach, Assistant General Passenger Agent, has resigned, effective January 15, to go into private business. Mr. Roach was born in Erie, Pa., and began railroad service in the engineering corps and later in the shops of the Canada Southern. After the road was taken over by the Michigan Central, Mr. Roach was made General Agent successively at Detroit, Toledo and Buffalo. In 1886

he was appointed General Eastern Passenger Agent of the New York Central in New York, and was promoted to Assistant General Passenger Agent three years ago.

Northern Pacific.—W. J. Horrigan has been appointed Freight Claim Agent, with headquarters at St. Paul, succeeding T. F. Hughes, resigned.

Engineering and Rolling Stock Officers.

Boston & Maine.—Henry Bartlett, who has been appointed General Superintendent of the Mechanical Department of the Boston &



Henry Bartlett.

Maine, was born on March 29, 1864, in Lowell, Mass. His early education was in the Lowell and Boston schools and he graduated from Harvard University. In March, 1886, he went to Altoona as special apprentice on the Pennsylvania, where he was for three years. From 1889 to 1891 he was Assistant Road Foreman of Engines successively of the Pittsburgh, Middle and Maryland divisions, and in 1891 became Assistant Superintendent of Motive Power at Altoona. He was appointed Superintendent of Motive Power of the Boston & Maine on January 1, 1895, the position

which he held until January 1 of the current year, when he was appointed to his new position, with headquarters at Boston.

Charles W. Higgins, who is now Superintendent of Motive Power, with headquarters at Boston, was born September 23, 1859, at Durham, N. H. He was educated at the public schools and Phillip's Exeter Academy. He began railroad work on July 1, 1882, on the road of which he has now been made Superintendent of Motive Power. For five years, from September 1, 1886, to October 1, 1891, he was a machinist in the Boston shops. In 1891 he was made Master Mechanic of the Concord division, and on July 1, 1895, of the Concord & White Mountains divisions. He became Assistant Superintendent of Motive Power on October 1, 1891, and was on January 1, 1897, promoted to his present position.

Buffalo & Susquehanna.—E. P. Tuffer has been appointed Engineer of the Northern division, with territory from Buffalo to Wells-ville.

Erie.—See Lehigh Valley.

Lehigh Valley.—G. W. Wildin, Mechanical Superintendent of the Erie, has been appointed Assistant Superintendent of Motive Power of the Lehigh Valley.

South Buffalo.—F. R. Cooper, formerly Master Mechanic of the Lehigh Valley, has been appointed Superintendent of Motive Power.

Union Pacific.—Martin Bylander has been appointed Acting General Shop Demonstrator, with headquarters at Omaha, Neb., succeeding F. M. Titus, temporarily assigned to other duties.

Purchasing Agents.

Dunkirk, Allegheny Valley & Pittsburgh.—See Lake Shore & Michigan Southern.

Lake Erie, Alliance & Wheeling.—See Lake Shore & Michigan Southern.

Lake Erie & Western.—See Lake Shore & Michigan Southern.

Lake Shore & Michigan Southern.—G. R. Ingersoll, chief clerk in the purchasing department, has been appointed Purchasing Agent, with headquarters at Cleveland, Ohio, of the Lake Shore & Michigan Southern, the Lake Erie & Western, the Lake Erie, Alliance & Wheeling and the Dunkirk, Allegheny Valley & Pittsburgh.

LOCOMOTIVE BUILDING.

The Missouri & North Arkansas has ordered five locomotives.

The Southern is reported to be asking bids on 50 locomotives

The Chicago, Milwaukee & St. Paul will build in 1907, 105 locomotives.

The Tidewater is reported to be in the market for eight locomotives.

The Northern Pacific is reported to be in the market for 25 locomotives.

The Nevada Northern is reported to be in the market for two locomotives.

The Chicago & North-Western is reported to be in the market for 80 locomotives.

The Kansas City Southern is likely shortly to purchase 20 consolidation (2-8-0) locomotives.

The Atlantic Coast Line is reported to have ordered 80 locomotives from the Baldwin Works.

The Evansville & Terre Haute is reported to have ordered eight locomotives from the Baldwin Works.

The National Tube Company, Pittsburg, is reported to be in the market for five switching (0-6-0) locomotives.

The American Railroad of Porto Rico has ordered a number of locomotives from the Baldwin Locomotive Works.

The Higginsville Switch Co. has ordered one 40-ton mogul (2-6-0) locomotive from the East St. Louis Locomotive & Machine Company.

The Lehigh Valley is reported to have ordered 55 locomotives, the order being divided between the American Locomotive Company and the Baldwin Works.

The Japanese Imperial Government Railways have ordered a number of locomotives from the Baldwin Locomotive Works through Frazar & Sale, New York.

The Chicago, Burlington & Quincy has ordered 25 Prairie (2-6-2) locomotives from the American Locomotive Company, in addition to the 55 locomotives reported in our issue of December 28, 1906.

The Wabash has ordered 70 Prairie (2-6-2) and 20 consolidation (2-8-0) locomotives from the American Locomotive Company, and 20 switching (0-6-0) locomotives from the Baldwin Works. The specifications are:

Type of locomotive	Prairie.	Consolidation.
Weight, total	265,000 lbs.	225,000 lbs.
Weight, on drivers	150,500 lbs.	200,000 lbs.
Diameter of drivers	70 in.	58 in.
Cylinders	22 in. x 28 in.	22 in. x 30 in.
Boiler, type	Radial stayed; extended wagon top.	
" wrkg. stm. pressure	200 lbs.	
" No. of tubes	301	360
" diameter of tubes	2 1/4 in.	
" length of tubes	19 ft.	14 ft. 6 in.
Firebox, length	72 1/4 in.	108 1/2 in.
" width		67 1/4 in.
Tank capacity	8,000 gals.	
Coal capacity	16 tons.	
Type of locomotive	Switching	
Weight, total	153,700 lbs.	
Diameter of drivers	52 in.	
Cylinders	21 in. x 26 in.	
Boiler, type	Radial stayed; straight boiler	
" working steam pressure	180 lbs.	
" No. of tubes	254	
" diameter of tubes	2 1/4 in.	
" length of tubes	15 ft.	
Firebox, length	72 in.	
" width	60 "	

The Des Moines Union has ordered two simple switching (0-6-0) locomotives from the Baldwin Works for June delivery. The specifications are as follows:

General Dimensions.	
Type of locomotive	Switching
Weight, total	100,000 lbs.
Diameter of drivers	51 in.
Cylinders	18 in. x 24 in.
Boiler, type	Wagon top
" working steam pressure	180 lbs.
" number of tubes	235
" diameter of tubes	2 in.
" length of tubes	11 ft. 1 1/2 "
Firebox, length	89 1/2 "
" width	34 3/4 "
" material	Schoenberger steel
" grate area	21.4 sq. ft.
Heating surface, total	1,488.9 "
Tank capacity	3,000 gals.
Coal capacity	4 tons

Special Equipment.

Air brakes	Westinghouse
Bell ringer	Golmar
Boiler lagging	Asbestos sectional
Couplers	Gould
Piston rod packing	Sullivan
Valve rod packing	Sullivan
Safety valve	Crosby
Sanding devices	Leach
Sight-feed lubricators	Nathan bull's-eye
Springs	French
Steam gages	Crosby

CAR BUILDING.

The Erie is reported to have issued specifications for 3,000 box cars.

The Southern is in the market for 35 passenger coaches and five chair cars.

The American Car & Foundry Co. has orders for 700 miscellaneous cars.

The Erie has ordered from the Pullman Company 60 vestibule suburban coaches.

The Kansas City Southern, it is reported, will soon be in the market for 1,400 cars.

The Pittsburg & Lake Erie has ordered one private car from the Pullman Company.

The Pittsburg, Shawmut & Northern is reported to be asking prices on 250 coke cars.

The Chicago, Milwaukee & St. Paul is reported to be in the market for ten motor cars.

The Chicago & North-Western has ordered 25 passenger cars from the Pullman Company.

The South & Western has ordered one passenger car from the Hicks Locomotive & Car Works.

The Lehigh Valley is reported to have ordered some passenger cars from the Pullman Company.

The Litcher & Moore Lumber Company has ordered 10 logging cars from the Orange Iron Works.

The New Orleans & North Eastern has ordered 125 gondola cars from the American Car & Foundry Co.

The El Paso & Southwestern is in the market for 250 steel under-frame stock cars of 60,000 lbs. capacity.

The Missouri & North Arkansas has ordered two passenger coaches from the American Car & Foundry Co.

The Walter A. Zelnicker Supply Company, St. Louis, has ordered five tank cars from Robert M. Burns & Company.

The Dry Fork Lumber Company has ordered 10 flat cars of 60,000 lbs. capacity from Robert M. Burns & Company.

The Indian Refining Company has ordered 39 tank cars of various capacities from Robert M. Burns & Company.

The Northern Pacific is reported to be ordering material for 100 cabooses to be built at its own shops during 1907.

The American Car & Equipment Company has ordered 20 gondola cars and five tank cars from Robert M. Burns & Company.

The Great Northern, as reported in our issue of January 11, has ordered 500 steel hopper cars from the American Car & Foundry Co.

The Erie, it is reported, has ordered 1,000 gondolas from the Pressed Steel Car Company and 2,000 gondolas from the Standard Steel Car Company.

The Lehigh Valley is reported to have ordered 5,000 freight cars, the order being divided between the Standard Steel Car Company and the American Car & Foundry Company.

The St. Louis Refrigerator Car Co., St. Louis, Mo., will build 200 steel underframe refrigerator cars of 80,000 lbs. capacity. These cars will weigh 52,000 lbs., and measure 37 ft. 3 in. long over all.

The Atlantic Coast Line is reported to have ordered 750 flat cars from the Standard Steel Car Company, and 1,000 box cars from Barney & Smith, and has ordered 1,500 box cars from the South Baltimore Steel Car & Foundry Company.

The Chicago, Milwaukee & St. Paul will build at its own shops in 1907, 3,000 steel underframe box cars of 80,000 lbs. capacity, 1,000 36-ft. standard stock cars, and 1,000 Haskell & Barker ballast cars, and after these are built 5,000 coal and 2,000 box cars.

The Great Northern will probably order during the year 1907 144 passenger cars. The order includes the following: Twelve 12-section sleeping cars, 10 18-section tourist sleeping cars, four dining cars, 30 first class coaches 70 ft. long, five second class coaches 60 ft. long, 25 baggage cars 65 ft. long, 15 baggage and mail cars 70 ft. long, 10 mail cars 60 ft. long, 30 express refrigerator cars, three 16-section sleeping cars.

The Tonopah & Goldfield, as reported in our issue of December 14, 1906, is asking bids on 115 drop bottom coal cars of 80,000 lbs. capacity. They will be 35 ft. 7½ in. long, 8 ft. 10 in. wide and 8 ft. 3¼ in. high, inside measurements. The special equipment is as follows:

Bolsters	Enterprise
Brake-shoes	Christie
Brakes	Westinghouse
Draft rigging	Miner
Wheels	Griffin

The Harriman Lines have ordered for the Cananea, Yaqui River & Pacific 75 flat cars from the Standard Steel Car Company. These cars will weigh 32,570 lbs., and will measure 30 ft. 10 in. long over floor, 9 ft. 4½ in. wide and 3 ft. 8⅝ in. high. There have been ordered for the Galveston, Harrisburg & San Antonio, as reported in our issue of January 11, four coaches and two mail and baggage cars from the St. Louis Car Company. The coaches

will weigh 88,000 lbs. and will be 60 ft. long, 9 ft. 8 in. high over sills, and 14 ft. 1⅞ in. high. The mail and baggage cars will be 60 ft. long. The specifications for these cars will be the same as for a previous order, reported in our issue of October 12, 1906.

The Missouri Pacific has ordered 3,000 gondola and 2,500 box cars from the American Car & Foundry Company; 2,000 box cars from the Mount Vernon Car Mfg. Company, and 750 ballast cars from the Rodger Ballast Car Company, to be built by the American Car & Foundry Company. All of these cars are to be of 80,000 lbs. capacity. Delivery to begin in April. The gondola cars are to be 36 ft. long, 9 ft. wide and 4 ft. high, inside measurements; all box cars will be 36 ft. long, 8 ft. 6 in. wide and 8 ft. high, inside measurements; all ballast cars will be 36 ft. long over end sills, 10 ft. 4 in. wide and 8 ft. 7½ in. high, over all. The special equipment for all brakes is Westinghouse; couplers, Tower; draft rigging, Miner.

The Buffalo, Rochester & Pittsburg, as reported in our issue of January 11, has ordered 500 steel hopper cars of 100,000 lbs. capacity from the Berwick Works of the American Car & Foundry Company. These cars will be 30 ft. long inside, 31 ft. 6 in. long over all, 10 ft. wide and 10 ft. high over all. The following special equipments will be used:

Bolsters	Scullin-Gallagher
Brake-beams	Pennsylvania Oval
Brakes	Westinghouse
Couplers	Climax
Doors	Dunham
Draft rigging	Sessions-Standard friction
Journal boxes	Symington
Paint	Railway Steel Spring

The Chicago Terminal Transfer, as reported in our issue of November 9, 1906, has ordered 300 side dump cars of 100,000 lbs. capacity from the McGuire, Cummings Mfg. Co. for March delivery. These cars will be 38 ft. long, 8 ft. 6 in. wide and 3 ft. 6 in. high, inside measurements. The special equipment is as follows:

Bolsters	American Steel Foundries
Brake-beams	Simplex
Brake-shoes	Congdon
Brakes	Westinghouse
Brasses	Ajax
Couplers	Washburn
Draft rigging	Miner
Journal boxes	Symington
Paint	Lowe Brothers
Springs	Railway Steel Spring Company
Wheels	Griffin

RAILROAD STRUCTURES.

BAY CITY, MICH.—The Michigan Central will soon start work on a new transfer freight house, to be 400 ft. long, with room for 40 cars, at the northern end of the viaduct crossing its yards on Marquette avenue.

CENTRAL CITY, NEB.—Local reports state that the Union Pacific will build a brick passenger station.

DENISON, TEX.—Work has been begun by the Missouri, Kansas & Texas on a new concrete freight house 45 ft. x 300 ft.

LITTLE ROCK, ARK.—A contract has been given to the Murch Bros. Construction Co., of St. Louis, for building the superstructure of the new union passenger station.

MIFELINVILLE, PA.—The Board of Public Grounds and Buildings at Harrisburg has given the contract for building a state bridge over the Susquehanna river here to the York Bridge Co. at \$122,000. There were 13 other bidders.

MONCTON, N. B.—The Intercolonial has given a contract to E. A. Wallberg, of Montreal, at about \$500,000, for putting up locomotive shops.

TROY, N. Y.—According to local reports, the New York Central has bought land on Adams street adjoining its present freight house, on which a large new freight house will be built.

VICKSBURG, MISS.—New passenger station is to be built for the Yazoo & Mississippi Valley at the corner of Grove and Mulberry streets, one block north of the present station. Work is to be started at once, and will cost about \$50,000.

WATERBURY, CONN.—According to local reports, plans are about ready for a new passenger station to cost \$200,000.

WORCESTER, MASS.—The Worcester Grade Crossing Commission is considering plans for a new concrete union passenger station.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ABILENE & NORTHERN.—See Colorado & Southern.

ANDERSON & SALINE RIVER.—This company, which last year built 10 miles of road from York, Ark., to Grant Spur, is making

surveys for a further extension to Leola, on the Chicago, Rock Island & Pacific, seven miles. Robert York, Treasurer and General Manager, Pine Bluff, Ark.

APPOMATOX & CHARLOTTE.—An officer writes that this company proposes to build a line from Drakes Branch, Va., northwest to West Appomattox, 40 miles. Address E. B. Eggleston, Charlotte Court House, Va. (See Construction Record.)

ARKANSAS, LOUISIANA & GULF.—An officer writes that permanent location has been made for a line from Pine Bluff, Ark., south to Monroe, La., 150 miles. Address E. G. Hammock, Monticello, Ark. (Sept. 7, p. 62.)

ARKANSAS PACIFIC.—An officer writes that contracts will be let by February 1 for building this line. Surveys are being made from Denison, Tex., to Memphis, Tenn., 469 miles. George D. Locke, Missouri Trust Building, St. Louis, Mo., is President. (Nov. 9, p. 128.)

CANADIAN RIVER.—See Santa Fe, Liberal & Englewood.

CINCINNATI, GEORGETOWN & PORTSMOUTH (ELECTRIC).—Contracts let to Thomas Daulton, of West Union, Ohio, for an extension from Russellville, Ohio, to West Union, 14 miles.

CLEAR LAKE & SOUTHERN.—Surveys are being made for building this proposed line from San Francisco, Cal., north to Lakeport, 130 miles. Le Grand Brown, 745 Monadnock Bldg., San Francisco, may be addressed.

COLORADO & SOUTHERN.—The Abilene & Northern is being extended from Abilene one mile south. M. T. Reed is the contractor. The road is projected from Abilene, Tex., south to Brady, 85 miles.

CORVALLIS & EASTERN.—An officer writes that surveys have been made for extending this road from Yaquina, Ore., west to Newport, five miles.

DANVILLE & MT. MORRIS.—An officer writes that this company is making surveys for a line from Danville, N. Y., south to Hornell, 16 miles. William Humphrey, General Manager, Danville, N. Y.

DELAWARE & HUDSON.—Contracts for double tracking this road from Schenectady, N. Y., southwest to Delanson, 13 miles, were recently let to Elmore & Hamilton, for \$600,000. It will take about eight months to complete the work. The contractors will shortly open an office in Albany or Schenectady and begin the work.

EASTERN TENNESSEE & WESTERN NORTH CAROLINA.—An officer writes that this company is laying third track to make the road double gage from Elizabethton, Tenn., to Hampton, five miles.

ELDORADO & WESSON.—This road, which is projected from Eldorado, Union County, Ark., southwest to Wesson, 10 miles, has completed grading and will soon begin track laying. James Harrington, Chief Engineer, Eldorado, Ark.

FRANKLIN & CLEARFIELD.—See Lake Shore & Michigan Southern.

GEORGIA COAST & PIEDMONT.—An officer writes that this company, which last year built 18 miles of road in Georgia, is making surveys to extend its line from Darien, Ga., south to Brunswick, 17 miles.

GLENVILLE & KANAWHA.—An officer writes that surveys are being made by this company for its proposed line from Glenville, W. Va., northeast to Weston, 30 miles. R. L. Ruddell, General Manager, Glenville, W. Va.

GULF & NORTHWESTERN.—Surveys have been made by this company for a line from Waco, Tex., northwest to Strawn, 120 miles. McCarthy, Starnes & Co., Lupton, Tex., are interested. The line is projected for an additional 250 miles from Strawn, northwest to Plainview.

GULF, HUTCHINSON & NORTHWESTERN.—This company is building with its own forces a line from La Crosse, Kan., north to Hays, 25 miles. The road is projected from La Crosse southeast to Hutchinson, 100 miles, and from Hays north to Phillipsburg, 75 miles.

KANSAS CITY, LAWTON & PACIFIC.—An officer writes that contracts have been given to R. F. King, of Ada, to W. T. Sherwin, of Paul's Valley, Ind. T., for building this line from Wagoner, Ind. T., southwest to Lawton, Okla., 250 miles, and from Wewoka, Ind. T., east to Dustin, 30 miles. E. A. Hill, Assistant General Manager, 401 Odd Fellows' Building, St. Louis, Mo.

KENTUCKY MIDLAND.—An officer writes that this company is building with its own forces a line from Central City, Ky., west to Earles, 10 miles. Surveys from that place west to Madisonville, an additional 12 miles, are under way. N. M. Wheeler, Chief Engineer, Central City, Ky.

KENTUCKY NORTH & SOUTH.—Surveys are being made for this line from Fullerton, Ky., on the Ohio river, to Bristol, Tenn., 200 miles. Work is to be started early this month. R. G. Taylor, Fullerton, Ky., is interested. (Oct. 26, p. 115.)

LAKE SHORE & MICHIGAN SOUTHERN.—Contracts let for building the Franklin & Clearfield from Franklin, Pa., southeast to Brookville, 56 miles, to the following firms: Crary Construction Co., McNalley Co., Ferguson Contracting Co., Mills Construction Co., King Bridge Co., and American Bridge Co. Samuel Rockwell, Chief Engineer, Cleveland, Ohio.

LAS VEGAS & TONOPAH.—Contracts let to Deal Bros. & Mendenhall for an extension from Rhyolite, Nev., north to Goldfield, 76 miles. (Sept. 14, p. 69.)

LIVE OAK, PERRY & GULF.—Extension being built from Rigler creek, Fla., west 30 miles.

LORAIN & ASHLAND.—An officer writes that this company, which recently completed six miles of road between Lorain and Wellington, is making surveys for an extension from Wellington south to Loudonville, 39 miles. Address August Mordecai, Wellington, Ohio. (Dec. 7, p. 161.)

LOTRINIERE & MEGANTIC.—An officer writes that this company has projected an extension of its road from Lyster, Que., to Lime Ridge, 60 miles.

LOUISIANA EAST & WEST.—Grading completed for an extension of this road from Ville Platte, La., to Eunice, 16 miles; track-laying with company's own forces under way. C. J. Carpenter, Superintendent, Bunkie, La.

MANGHAM & NORTHEASTERN.—This company, which built one mile of road in Louisiana last year, is building three miles additional from Mangham to Baskinton. O. A. Wright of Mangham, La., is interested.

MESSABE SOUTHERN.—This road has been opened for operation from St. Louis River, Minn., to Gowans, 38 miles.

NATCHEZ, COLUMBIA & MOBILE.—This company, which last year built an extension from Divide to Loweton, Miss., 3½ miles, is building with its own forces an extension from the latter place to Pearl river, 3½ miles.

NEW YORK, AUBURN & LANSING.—An officer writes that this company, which built 19 miles of line from Auburn to Genoa, N. Y., south, last year, has given contracts to the Auburn Construction Co., of Auburn, N. Y., and work is now under way from Genoa south to Ithaca, 20 miles. Both steam and electricity are to be used as motive power. H. A. Clarke, Chief Engineer, Wright avenue, Auburn, N. Y.

NORTH & SOUTH TEXAS.—This company, which last year built two miles of road from Groveton, Tex., northwest, will shortly let contracts for the additional 34 miles to Lufkin; also from Groveton to Oakhurst, 25 miles. Surveys are also being made from Oakhurst to Houston, 70 miles. McCarthy, Starnes & Co., Lufkin, Tex., are interested.

OKLAHOMA CENTRAL.—An officer writes that contracts have been let for extending this road from Purcell, Ind. T., to which point the road was completed last year, west to Chickasha, 42 miles. Surveys also completed from Lehigh, the present southern terminus, southeast to Paris, Tex., 86 miles. F. C. Hand, Chief Engineer of Construction, Purcell, Ind. T.

OREGON & SOUTHEASTERN.—An officer writes that this company, which built two miles of road in Oregon last year to mile post 20, has projected an extension from that point to Bonita, seven miles.

OREGON SHORT LINE.—It is said that this company is planning to build a line through Boise, Idaho, which is to form part of the main line of its Idaho division.

POUND GAP-ELKHORN.—Incorporated in Kentucky, with \$100,000 capital, by C. T. Smith and G. W. Morehead, of Elkhorn City; W. Meredith and J. Day, of Hellier, Ky., to build a 25-mile line from Pound Gap near the Kentucky-Virginia state line; not yet surveyed.

POWELLS VALLEY.—Surveys are being made by James R. Russell, of Blackwood, Va., from Blackwood up Powells river, about 12 miles, to coal and timber lands.

ST. LOUIS BELT & TERMINAL.—This company last year built eight miles of road in Missouri, from Easton avenue, St. Louis, to Hanly road, and is planning to build an extension to the St. Louis & San Francisco, two miles. B. C. Jackson, Chief Engineer, St. Louis, Mo.

SALT LAKE & OGDEN.—This company is building with its own forces an extension of its road from the Davis-Weber county line to Ogden, 5½ miles; also from Ogden to Ogden Canyon, 2½ miles. Grading has been finished on all of this except a mile and a half on the line to Ogden.

SAN DIEGO & ARIZONA.—An officer of the San Diego Eastern writes that the franchises and other property of this company have

been sold to J. D. Spreckels, who has formed a new corporation under the above name and proposes to at once build a line from San Diego, Cal., east to the Colorado river, 200 miles. (Dec. 21, p. 175.)

SAN DIEGO EASTERN.—See San Diego & Arizona.

SANTA FE, LIBERAL & ENGLEWOOD.—Work is now under way on a new through line through New Mexico, Kansas and Oklahoma, to be known as the Santa Fe, Liberal & Englewood system, consisting of four sections, two of which are already completed. The first section is the Santa Fe, Raton & Eastern from Raton, N. Mex., east to Carlsbrooke, 16 miles, with two branches forking north into the coal fields of Colfax county; the second section, the Santa Fe, Raton and Des Moines, from Carlsbrooke, N. Mex., east to Des Moines, 40 miles. The third section, the Santa Fe, Liberal & Englewood proper, is building the whole length of Beaver County, Okla., from Des Moines east to Hooker, where connection is made with the C., R. I. & P.; from Hooker the main line is to run east to Woodward, Okla. The fourth section, the Canadian River, is to run from Woodward, Okla., southeast to Watonga, from which point connections with the Atchison and Rock Island is made by two lines, one to Guthrie, and the other to Oklahoma City. The whole road is to be stone ballasted, with steel bridges and zinc treated ties 3,000 to the mile and to be laid with 85-lb. rails. Maximum grades will be 0.6 per cent. eastbound and 0.8 per cent. westbound. It will depend largely for its earnings hauling coal from the large coalfields in Colfax County, New Mexico. The annual output of coal from fields adjacent to the road is estimated at 1,000,000 tons, and it is also expected that the road will haul annually 100,000 tons of ice.

SANTA FE, RATON & EASTERN.—See Santa Fe, Liberal & Englewood.

SANTA FE, RATON & DES MOINES.—See Santa Fe, Liberal & Englewood.

SHELBY LONG FORK.—J. M. Stewart, of Ashland, Ky., and Eugene Zimmerman, of Cincinnati, Ohio, are quoted as saying that this road is to be extended up Long Fork valley from Shelby Station on the Chesapeake & Ohio, through Pike and Letcher Counties to coal fields, about 40 miles.

SIBLEY LAKE, BISTENEAU & SOUTHERN.—An officer writes that this company is building a four mile extension in Louisiana; contract let to Blackman Bros. J. H. Martin, General Manager, Yellow Pine, La.

SPRINGFIELD, CLEAR LAKE & ROCHESTER (ELECTRIC).—This company, which last year built two miles of electric road from Springfield, Ill., east, will build during the present winter 10 miles additional to Rochester. A further extension is projected south, also from Rochester, to Pawnee, about 15 miles. J. E. Nelick, Springfield, Ill., is Superintendent.

TAMPA NORTHERN.—This company is building an extension of its road from Tampa, Fla., to Brooksville, 48 miles.

TENNESSEE & NORTH CAROLINA.—Surveys are being made for an extension of this road from Waterville, N. C., to Canton, 35 miles.

TENNESSEE RAILWAY.—An officer writes that this company, which last year built 14 miles of road in Tennessee, has given contracts to Walton, Wilson, Rodes & Co., of Knoxville, Tenn., for extending its road from Smoky Creek to Beech Fork, six miles, and from Smoky Creek to Asher's Fork, 8½ miles. The company is planning to reduce grades on the old line in Scott County between Oneida and Almy, eight miles. W. O. Dyer, Chief Engineer, Oneida, Tenn.

TEXAS SOUTHEASTERN.—An officer writes that this company, which last year built eight miles of road in Texas, is building a line from Vair to Lufkin, 10 miles.

UNION PACIFIC.—The plans for changing the grade on the Athol Hill section of the Denver-Cheyenne branch of this road it is said include a double cut-off, one part of which is to end at Cheyenne and the other at a point between Boris and Granite Canon stations, respectively eight and 18 miles west of Cheyenne. The proposed route of these cut-offs is from a point 20 miles south of Cheyenne on the present line west up Lone Tree Valley for several miles to a point about 10 miles southwest of Cheyenne, where the line will divide into two branches, one running northeast to Cheyenne, and the other northwest to a junction with the main line between Boris and Granite Canon.

WISCONSIN CENTRAL.—The Lake Superior & Southeastern, which this company is building north to Duluth, Wis., has been built from Owen to Ladysmith about 45 miles, and considerable grading completed beyond that point. It is expected to have the road completed to Duluth by the middle of this year. The new line will provide a direct and short route for ore shipments from the Hill roads in Northern Minnesota.

It is probable that this company will build a connecting line from Portage, Wis., south to Janesville, on the Illinois, Iowa & Minnesota, about 40 miles.

RAILROAD CORPORATION NEWS.

ALEXANDER & EASTERN.—This is the new name of the Alexander & Rich Mountain Railway, which has 18 miles of line from Alexander, W. Va., to Long Run Junction, including a three-quarter mile branch up Long Run and a one-half mile branch up the left fork of Buckhannon river. The road is operated only for freight traffic.

ALEXANDER & RICH MOUNTAIN.—See Alexander & Eastern.

ATCHISON, TOPEKA & SANTA FE.—See Northwestern Pacific.

BOSTON & MAINE.—An issue of \$3,000,000 one-year notes has been sold to a syndicate consisting of Kidder, Peabody & Co., R. L. Day & Co., Esterbrook & Co., and F. S. Moseley & Co. Of this issue \$1,000,000, already sold, are dated January 15.

An issue of \$2,000,000 Fitchburg Railroad, 4 per cent., 20-year bonds dated April 1, 1907, has been sold to Moffat & White, of New York. Of this issue \$1,500,000 is for refunding and the other \$500,000 to reimburse the Boston & Maine for improvements to the Fitchburg. The new bonds are legal investments for savings banks in Massachusetts and Connecticut.

CALIFORNIA NORTHWESTERN.—See Northwestern Pacific.

CHICAGO & NORTH-WESTERN.—At a meeting of the Board of Directors on January 15 it was resolved that to obtain funds for constructing, improving and equipping the road there be issued \$24,403,105 common stock, equal to 25 per cent. of the total preferred and common shares now outstanding. There is \$22,395,120 Chicago & North-Western preferred and \$75,217,300 common outstanding, a total of \$97,612,420. A little more than \$100,000,000 new common stock was authorized by the stockholders at the annual meeting on October 18, 1906. Chicago & North-Western rights on the new issue opened at about 18 on the New York Curb.

CINCINNATI, HAMILTON & DAYTON.—The *Commercial and Financial Chronicle* learns from Judson Harmon, Receiver, that no receiver's certificates were issued to raise funds to pay the interest due January 1, 1907, on bonds of the Cincinnati, Hamilton & Dayton and Pere Marquette, as the net earnings were sufficient. The receiver's certificates dated January 1, 1906, which matured January 1, 1907, were extended for six months at 6 per cent. The previous rate of interest was 5 per cent.

DELAWARE & HUDSON.—See United Traction Company.

EUREKA & KLAMATH RIVER.—See Northwestern Pacific.

ILLINOIS CENTRAL.—On January 10, Governor Deneen sent a special message to the legislature dealing with the question of taxes due by the Illinois Central to the state, in which he held that the railroad company had never complied with the requirements of its charter providing that it render a correct accounting and an honest and fair division of the receipts and income of the entire system, among the shorter lines and the lines leased, owned and operated by the company. He takes the position that the Illinois Central was authorized to construct, own and operate only the main line and the two branches there described, and alleges that the state has been defrauded by the division of earnings among the different lines.

A resolution was introduced in the Illinois Senate on January 15 calling for a committee of senators to investigate the election of J. T. Harahan as President of the Illinois Central on the ground that the election was illegal because it took place outside the state; also to inquire into the right of the board of directors to act, as only two of the 12 directors are residents of Illinois, while the law provides that a majority of the directors of an Illinois railroad corporation shall be residents of the state.

LEHIGH VALLEY.—At the annual meeting, which opened on January 15, President Thomas made the following answer to the request from some of the stockholders for larger dividends:

At a time when there is so much uncertainty as to the future cost of operation and the effect on the company of recent laws, your Board believes a conservative policy in the matter of dividends is to the best interests of the stockholders. The labor situation is unsettled. Heavy demands have been made on the company for shorter hours and increased wages because of the increased cost of living and higher rates of wages paid by others, many of which have been granted where a fair and impartial review of the situation indicated the necessity of so doing. This will have its effect in tending to increase the future expense of operation. The shortage of freight equipment cars which is everywhere engrossing the attention of both railroad officials and the general public is one that must be dealt with broadly in order to carry on the continued prosperity of the country.

It must be borne in mind that the business of producing anthracite coal is not alone a mining proposition, but a manufacturing and commercial undertaking as well. The combined gross business of the railroad and coal companies is over \$65,000,000 a year, and to provide ample working capital, as well as to meet expenditures for current improvements as they become due, it is necessary to have ample cash balances constantly at the

company's disposal, even though the cost of such work is not included in operating expenses, but is ultimately charged to capital account and provided for by the issue of securities.

If the railroads of this country are to be successful and their securities are to become desirable investments, the physical managements of the properties must appeal to the public sense as satisfying reasonable requirements, and their financial operations must command the confidence of investors. It is to that class this management appeals. They are the class by whom the bulk of the company's securities are held, the speculative holders being comparatively few, and it is to the conservative investing class, who believe in this property as a means of investing their funds, that this management looks for support. It is the belief of the management that it has had, and still has, the confidence of this class, and the fact that they have had confidence in the property and in the management is indicated by the few changes in the stockholders for many years, both during the period when no dividends were paid and at the present time, when the market value of the stock has been so considerably enhanced by the increased earnings and better financial conditions.

LITTLE MIAMI.—At the annual meeting to be held on January 29 important modifications will be made to the lease under which the road is held by the Pennsylvania Company, and the capital stock is to be increased from \$8,000,000 to \$10,000,000 to buy the Dayton & Western Railroad, which is under lease to the Little Miami.

MOBILE, JACKSON & KANSAS CITY.—This road, which has been freed from its recent brief receivership and returned to its former managers, has issued an annual report for the year ended June 30, 1906. This shows gross earnings of \$1,083,692 against \$677,528 in 1905, and net earnings of \$309,931 against \$273,385. There was a surplus of \$29,000 against \$18,800 in 1905. These results were obtained on the basis of a ton-mile rate of 2.2 cents and a passenger-mile rate of 2.74 cents, both of which, however, are large decreases from the 1905 figures.

NEW YORK & PORTCHESTER.—The New York State Railroad Commissioners have approved the issue by this company of a mortgage for \$20,000,000 and an increase of its capital stock from \$250,000 to \$20,000,000. It appears that substantially all of the capital stock of the New York, Westchester & Boston, whose proposed line runs over nearly the same route as that of the New York & Portchester, is owned by the owners of the stock of the New York & Portchester. It is agreed that at no time shall the total amount of mortgage bonds or of capital stock outstanding on both railroads exceed \$20,000,000.

NEW YORK CENTRAL & HUDSON RIVER.—The New York State Court of Appeals has reaffirmed a decision of the lower courts in favor of the New York Central as lessee of the New York & Harlem. The question at issue was as to whether the New York Central should get the benefits of the interest saved through refunding \$12,000,000 7 per cent. bonds into 3½ per cent. bonds. An agreement had been ratified by a majority of the stockholders of the two companies that in return for the advantage gained by the New York Central through refunding, the dividends on the Harlem stock should be increased from 8 to 10 per cent., and this was held a valid agreement.

NEW YORK, CHICAGO & ST. LOUIS.—A dividend of 4 per cent. was on January 16 declared for the year on the second preferred stock against 3 per cent., which has been paid for the past four years. In 1901 the stock received 2 per cent., and before that nothing.

NEW YORK, NEW HAVEN & HARTFORD.—An issue of \$10,000,000 5 per cent. notes, half of which mature in four and half in five years, has been sold to Hornblower & Weeks, and Lee, Higginson & Company. An earlier issue of \$7,000,000 5 per cent. notes, one-half maturing in four years and one-half in five years, was also sold to the same firms. These issues of \$17,000,000 in short term notes follow an issue of \$6,000,000 of similar securities late in December, making a total of \$23,000,000 in 5 per cent. short term notes recently sold by the New Haven road.

The New York, New Haven & Hartford has bought at a price of about \$1,000,000 land from the Boston Consolidated Gas Company, to be used as a steamship terminal.

NORTH SHORE.—See Northwestern Pacific.

NORTHWESTERN PACIFIC.—This company was incorporated in California on December 21, 1906, as a joint enterprise of the Atchison, Topeka & Santa Fe and Southern Pacific to consolidate railroads owned by these two companies north of San Francisco. The new company is capitalized at \$35,000,000, and its directors are E. E. Calvin, William F. Herrin, W. T. Smith and Peter F. Dunne, of the Southern Pacific, and A. H. Payson, E. S. Pillsbury and Edward Chambers, of the Santa Fe. The roads merged into the Northwestern Pacific are the California North-western, the San Francisco & Northern Pacific, the North Shore and the Eureka & Klamath River, controlled by the Southern Pacific, and the San Francisco & Northwestern and Fort Bragg & Southeastern, controlled by the Santa Fe. The consolidated company has something over 500 miles of road. By building a 150-mile connecting line between the northern terminus of the

California North-western at Sherman, Cal., and the southern terminus of the San Francisco & Northwestern at Camp 5, a through route will be established over these roads from San Francisco north to Trinidad, about 300 miles.

PENNSYLVANIA.—It was announced on last Thursday that at the annual meeting of the stockholders of the Pennsylvania on March 12 authority would be asked to increase the capitalization probably by \$100,000,000 in capital stock and \$100,000,000 in bonds. The reasons given for the new issue were that the amount of capital stock already issued with that reserved for conversion of outstanding convertible bonds nearly approximates the full sum now authorized. Though it may not be necessary to issue any of the new capital during the current year, yet the company desires authority to make such issues should circumstances require. As the increase in capital must first be authorized by a majority of the stockholders, early announcement was made of the proposed increase in order to give stockholders due time for consideration before the annual meeting. The announcement of this proposed increase in the capitalization of the company came as a general surprise, and was followed by a decline of four points in Pennsylvania stock at the opening of the New York stock market on January 11. The Pennsylvania has within the last few years called for great amounts of new capital, the authorized stock having been increased in six years from \$151,700,000 to \$400,000,000. Of the total authorized issue of \$400,000,000 there is outstanding a little over \$300,000,000. At the time the Pennsylvania loan of \$48,250,000 was placed in France last June, President Cassatt stated that as far as could be seen no large capital requirements would have to be met for some years beyond what will be necessary to pay off \$50,000,000 notes maturing November 1, 1907, and to provide money needed in 1907 and 1908, estimated at \$40,000,000, to complete the New York terminal. It is not possible to determine from the official statement in regard to the proposed issue how much new capital it really represents. In case the bonds are convertible, part of the \$100,000,000 new stock would probably be used for converting the bonds.

The Pennsylvania has issued a statement of earnings for the year ended June 30, 1906. Gross earnings were \$141,752,620 and net earnings \$44,808,237; net income was \$22,622,063, dividend requirements \$18,242,068, surplus \$4,379,995, other deductions \$1,408,845, and net surplus \$2,971,160. The regular fiscal year of the Pennsylvania ends on December 31.

PERE MARQUETTE.—See Cincinnati, Hamilton & Dayton.

SAN FRANCISCO & NORTHERN PACIFIC.—See Northwestern Pacific.

SAN FRANCISCO & NORTHWESTERN.—See Northwestern Pacific.

SANTA FE, LIBERAL & ENGLEWOOD.—This is the name of a projected road in Oklahoma with which are to be consolidated two recently built roads in New Mexico and another projected railroad in Oklahoma. These four roads which, when built, will make a new through line about 600 miles long from Raton, N. Mex., to Guthrie and Oklahoma City, Okla., are the Santa Fe, Raton & Eastern, now built from Raton to Carrisbrooke, 16 miles, with two branches running northward into the coal fields of Colfax County, and the Santa Fe, Raton & Des Moines, running from Carrisbrooke east 40 miles to Des Moines, New Mexico. The Santa Fe, Liberal & Englewood is to be 221 miles long and run the length of Beaver County, Okla., connecting Des Moines, N. Mex., with Englewood, Kan., and Woodward, Oklahoma. The other projected railroad is the Canadian River Railroad, which is to run from Woodward, Okla., southwest to Guthrie and Oklahoma City, 220 miles. The whole road is to be built with 85-lb. rails and maximum grades 0.6 per cent. eastbound and 0.8 per cent. westbound. There are to be \$14,800,000 first mortgage 5 per cent. 30-year bonds and the same amount of stock.

SANTA FE, RATON & DES MOINES.—See Santa Fe, Liberal & Englewood.

SANTA FE, RATON & EASTERN.—See Santa Fe, Liberal & Englewood.

SOUTHERN PACIFIC.—See Northwestern Pacific.

UNITED TRACTION COMPANY.—This company, which owns the street railway systems of Albany, Troy and Cohoes, N. Y., and is controlled by the Delaware & Hudson, has increased its stock from \$5,000,000 to \$12,500,000, the increased funds to be used in buying the Hudson Valley Railway, which runs north from Albany and Troy with about 100 miles of line, and has hitherto been an independent electric road.

WABASH.—Application has been made to the New York Stock Exchange to list \$16,500,000 additional preferred and \$16,500,000 additional common stock.